

FM 55-30

DEPARTMENT OF THE ARMY FIELD MANUAL

MOTOR TRANSPORTATION OPERATIONS



HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 1963

FIELD MANUAL }
No. 55-30

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 29 October 1963

MOTOR TRANSPORTATION OPERATIONS

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* This manual supersedes FM 25-10, 8 January 1959.

PART ONE

GENERAL

CHAPTER 1

INTRODUCTION

1. Purpose and Scope

a. Purpose. This manual provides the information necessary for troops of all branches to understand the principles of planning, operation, and control essential to successful military movements by motor vehicles.

b. Scope. This manual is limited in scope to the principles and basic techniques of planning, operation, and control. References are made to publications offering detailed treatment of techniques and procedures. This manual is designed as a common text for the use of command, staff, and operating personnel of all branches in the training for and conduct of all military motor movements. Definitions of terms relating to motor movements, explanations of march formations and traffic control measures to include the duties and responsibilities of operating personnel, and explanations of movement planning techniques and planning aids are included. Operations under varying terrain, climate, and tactical conditions are treated insofar as they affect the planning and execution of motor movements. The material presented herein is applicable without modification to both nuclear and nonnuclear warfare.

c. Comments. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to U. S. Army Combat Developments Command Transportation Agency, Fort Eustis, Va.

2. General

Modern war is war of movement. The speed and facility with which the commander may effect the distribution or concentration of personnel, equipment, and supplies may decide the outcome of an operation. Nuclear capabilities of modern armies with the resultant tactical dispersion accentuate this need for mobility in both offense and defense. Since motor transportation supplies a large percentage of this mobility, it is important that organization and training for efficiency in motor movements be stressed by all branches at all levels.

a. Metric System of Measurement. AR 525-8 directs that the linear system of measurement be used to indicate linear distances (kilometers and meters). In motor transportation operations, this requirement is related to the unit of measure shown on vehicle odometers and to the available maps of the area. It is essential that drivers be trained in the metric system so that they can use maps which use this system. In this manual, the expressions "kilometers or miles" and "meters or yards" are used wherever appropriate. Primary emphasis, however, should be placed upon the metric system.

b. Terms Indicating Location. The material contained in chapter 4 is applicable to any area in which hostile interference is possible. Chapter 5 is applicable to any area in which the civil government is stable and friendly.

3. Uses of Motor Transport

a. In the combat zone where all military movements are subject to enemy action, motor transport is commonly used for the transporta-

tion of personnel, equipment, and supplies. The modern military motor vehicle has inherent characteristics of good cargo capacity, relatively high highway speeds, adaptability, and flexibility of independent movement. Successful motor movements exploit these characteristics to the utmost through training, careful planning, and adequate control. The basic function of military motor transport is to move personnel and materiel from origin to destination to give timely and effectual tactical and logistical support to military operations. Functionally, military motor movements are divided into two general classifications, tactical and administrative. Tactical movements are characterized by the maximum exploitation of the mobility of motor transport for timely delivery of units and supplies to their destinations in the best formation and condition for the accomplishment of the assigned mission. In tactical motor movements unit integrity for tactical control, combat loading for ready availability on contact, and speed of movement are of greater importance than economy of cargo capacities. Administrative movements are characterized by the maximum use of available transport. Tactical considerations in administrative movements are of less importance than economical use of cargo capacities and operating personnel.

b. Motor movements, both tactical and administrative, may utilize organic transportation, vehicles of attached or supporting units, or a combination of both as the situation demands. *Organic transportation* includes those vehicles regularly assigned to a unit by tables of organization and equipment, by tables of allowances, or by equipment modification lists. Supporting or attached transportation may be designated to facilitate a motor movement based upon estimates of requirements, availability, and established priorities.

4. Types of Motor Movements

Motor movements may be further classified by the degree of control as—

a. *Casual Military Movements.* Those movements which consist of individual elements proceeding more or less at will in the performance of routine administrative, staff, command, supply, and evacuation functions of units.

b. *Organized Military Movements.* Movements consisting of tactical units or supply

convoys in which elements are grouped together for adequate control.

c. *Unorganized Traffic.* Movement without control, including refugee and local civilian traffic as well as military traffic other than that classified in a and b above. The presence of unorganized traffic necessitates immediate emergency control measures to restore efficient use of the road net.

5. Conditions Affecting Motor Movements

Military motor movements are affected by a wide variety of conditions over which planning and operating personnel have no direct control. These conditions can be anticipated to a varying degree and provisions made for operation and control. All plans and operations must, however, maintain sufficient flexibility to meet unpredicted weather, terrain, or tactical conditions as they arise. Examples of varied conditions and general provisions for operation under these conditions include the following:

a. *Civilian Controls.* Motor movements made within the continental United States, and usually those in the territory of a friendly nation, are subject to civilian traffic laws and regulations. Coordination with civil authorities is therefore necessary for proper clearances prior to executing motor movements.

b. *Terrain and Climate.* Conditions of terrain and climate may seriously restrict the mobility of motor vehicles and often require special training and issues of special equipment. Adequate prior planning will minimize the adverse effects of those conditions. See chapters 8 and 9 for effects of climate and terrain.

c. *Highway Conditions and Road Net.* An adequate road net with highways and bridges suitable for all classes of military traffic will not be present in many areas. It is important that route reconnaissance by cavalry, engineer, air, military police, or organic reconnaissance personnel be as thorough as time and the tactical situation will permit so that the most effective use may be made of the available road net and early provision made for necessary engineer support.

d. *Tactical Conditions.* In theaters of operations, particularly in the combat zone, tactical conditions demand the highest consideration in both the planning and the execution of motor

movements. Tactical conditions include all conditions imposed by the enemy such as air, artillery, or CBR attack; raids, guerrilla action, and sabotage; and conditions imposed by the operational plans of our own forces. March or convoy organization reflecting current intelligence, command structure providing efficient command channels suitable for anticipated action, and the assignment or designation of adequate security detachments are basic provisions in plans and orders for movements under tactical conditions. Local standing operating procedures (SOP) for the defense of a column against ambush, normally based on the principle of a strong attack on the ambushing force,

must be developed and thoroughly understood by all personnel. The introduction of chemical, biological, and nuclear weapons systems to the modern battlefield amplifies the requirement for thorough training at all echelons in the employment of active and passive defenses against these forms of attack. No unit can be considered combat operational until it is thoroughly trained in the employment of cover, concealment, and dispersion; in detecting, marking, and traversing or avoiding CBR-contaminated areas; in moving through friendly or enemy smoke screens; in decontaminating personnel and materiel; and in other individual and unit protective measures.

CHAPTER 2

PRINCIPLES OF MOTOR TRANSPORTATION OPERATIONS

Section I. COMMON FACTORS IN MOTOR MOVEMENT

6. The Military Motor Vehicle

A motor vehicle is any vehicle propelled by a self-contained power unit, except a vehicle designed primarily for use on railways or other trackage, and materials handling equipment. For the purposes of this manual, the term "motor vehicle" will include vehicles designed to be towed by a motor vehicle.

a. Military motor vehicles are divided into two general classes according to use and design.

- (1) *Tactical vehicles.* Vehicles designed primarily to meet field requirements in connection with combat and tactical operations. Tactical use of a vehicle is any use in direct connection with combat or tactical operations or the training of troops for these operations.
- (2) *Administrative vehicles.* Vehicles, normally of commercial type, suitable for routine purposes in connection with the transportation of supplies, personnel, or equipment at installations. Administrative use of a vehicle is any use not directly connected with combat, tactical, or service unit operations or the training of troops for these operations. Tactical vehicles may be designated and used as substitutes for administrative vehicles by the Department of the Army. Basic policies and detailed procedures for the management and use of administrative motor vehicles and for the operation of transportation motor pools are provided in TM 38-660-1.

b. Vehicles are further classified as—

- (1) *General purpose vehicles.* Motor vehicles designed to be used interchangeably for movement of personnel, supplies, ammunition, or equipment or for towing artillery carriages, trailers, or semitrailers. They are used without modification to body or chassis to satisfy general automotive needs.
- (2) *Special-equipment vehicles.* Motor vehicles the chassis of which are identical, except for minor alterations, to those used in general-purpose vehicles, but which have a special body or special equipment mounted thereon.
- (3) *Special-purpose vehicles.* Motor vehicles designed and intended for a specialized requirement for which no general-purpose chassis can be adapted. This category includes items that are specified from time to time by the technical services. All tractors, regardless of size or intended purpose, will be classified as special-purpose vehicles. Special-purpose vehicles are separate and distinct from combat vehicles.
- (4) *Combat vehicles.* Motor vehicles, with or without armor or armament, which are designed for specific fighting functions. Limited armor protection or armament mounted or installed on general-purpose, special-equipment, or special-purpose vehicles will not change the classification of such vehicles to combat vehicles.

(5) *Trailers.* Vehicles designed to be towed and provided with a drawbar or tongue for attachment to a coupling mounted on the towing vehicle. Trailers are classified as to type (general purpose, special equipment, special purpose, combat) in the same manner as self-propelled vehicles. For the purposes of this manual, trailers are included in the term "motor vehicle," except that towed artillery carriages are classified as motor vehicles for matters concerned with traffic regulations, speed limits, road accidents, and load size limitations only.

(6) *Semitrailers.* Vehicles designed to be towed and to be supported in part by a prime mover through a fifth wheel or similar coupling. Semitrailers are classified and considered in the same manner as trailers.

c. Military motor vehicles are developed and designed to insure the performance of necessary tactical and administrative transportation functions under varied conditions. Military requirements generally limit the use of unmodified commercial-type vehicles to administrative uses within the United States. Design specifications and performance characteristics of vehicles developed for military use indicate their capabilities and limitations under various conditions. Military personnel must recognize these capabilities and limitations to make the most efficient use of available transportation. The basic factors controlling vehicular performance characteristics are defined below.

- (1) *Gradability.* The ability of a vehicle to negotiate a slope while carrying its designated payload with its transmission in the lowest forward gear.
- (2) *Traction.* The ability of the wheels or track of an automotive vehicle to adhere to the road.
- (3) *Fordability.* The ability of a vehicle to negotiate a depth of water without stalling the engine.
- (4) *Momentum.* The energy stored up by the mass of the vehicle in motion and

increasing proportionately with the speed and weight of the vehicle and load.

- (5) *Flotation.* The ability of a wheel or track to resist sinking into the surface supporting it, increasing with the area of ground contact per pound of weight and varying inversely with ground pressure (expressed in pounds per square inch).
- (6) *Power.* The force built up by the engine and transmitted to the wheels or track to produce motion. Power in any gasoline-propelled vehicle depends upon maintaining proper engine speed. A shift to a lower gear gives more effective use of power, but with a proportional loss of speed.
- (7) *Trafficability.* The capacity of a soil to withstand traffic.
- (8) *Traction capacity.* The ability of a soil to resist the vehicle tread thrust required for propulsion and steering.
- (9) *Bearing capacity.* The ability of a soil to support vehicles without excessive settling.
- (10) *Other factors.* Other factors which limit or extend the capabilities of vehicles under various conditions include ground clearance; angle of approach; angle of departure; turning radius; gross weight and weight distribution and height, width, and length.

7. Utilization of Vehicles

A major factor in successful motor transportation operations is the maximum effective utilization of vehicles in support of tactical operations.

a. *Command Responsibility.* It is the responsibility of command in every echelon to insure that motor transportation is so maintained and administered as to give the needed mobility and flexibility to tactical commanders when needed. Normal military maintenance programs, properly administered and supervised, will pre-

serve the mobility of the unit under normal conditions. Combat conditions, however, demand additional initiative at all levels.

b. Drivers Duties and Responsibilities. The military driver must be thoroughly trained in the safe operation of his assigned vehicle under all conditions and in certain limited maintenance procedures. It is his responsibility to operate the vehicle in an acceptable manner, to report deficiencies, and to perform first echelon maintenance. The drivers efficient performance of his duties in operation and preventive maintenance is the foundation of efficient motor transportation.

c. Maintenance. Based upon drivers reports of deficiencies and shortcomings and upon periodic inspections, it is the duty and responsibility of unit maintenance sections to keep vehicles in a safe and efficient operating condition. Thorough training and adequate supervision of maintenance personnel will lessen the time necessary for repairs at installations and on the march.

d. Administration. Administrative waste of motor transportation through improper dispatch, loading, and routing may reduce the effective mobility of a unit as much as poor operation or poor maintenance. Being less tangible than improper operation or inefficient maintenance, moreover, administrative deficiencies may become more serious than the other types before corrective action is taken.

8. Highway Characteristics and Use

Because all military motor movements contemplate the use of an existing highway system to the greatest extent possible, both planning and operating personnel must be well-informed on the characteristics of the military road maneuver network involved. They should know its capacities and restrictions, its critical points, and the possible effects of enemy actions on it.

a. Highway Characteristics. The characteristics of a road network include road widths and surfaces, lengths and load-bearing capacities;

alignment (hills and curves); natural and artificial obstructions which might cause bottlenecks or slow down movement; and the classification of tunnels, bridges, ferries, and fords. The collection, analysis and use of accurate data on highway characteristics is particularly important in theaters of operation due to the increasing demands imposed by military traffic and the primitive conditions encountered in many areas. Road capacity is determined by calculation of the number of vehicles or gross tons that can pass over the most restricted point of a route in the same direction, *under the existing conditions*, in a given time.

b. Highway Regulation. Highway regulation, primarily a Transportation Corps function (FM 55-31), is the planning, scheduling, routing, and directing of the actual use of the highways by vehicles, personnel on foot (including troops, refugees, and others), and animals so as to meet military operational requirements. Highway regulation becomes increasingly important as combat areas are approached and both tactical and supply traffic are increased. Enemy action may further limit the use of the existing road network, making highway regulation more necessary to the timely delivery of critical personnel, equipment, and supplies. The planning of highway regulation must provide flexibility to allow modification to meet changes in the situation with a minimum of confusion.

c. Highway Traffic Control. Highway traffic control, a Military Police Corps responsibility, is prescribed in the traffic control plan prepared by the provost marshal and implemented by military police who enforce traffic rules, regulations, and orders; conduct traffic control reconnaissance, surveys, and studies; direct traffic at points of conflict or congestion; operate traffic control posts, patrols, and escorts; operate dismount points, roadblocks, checkpoints, restrictive control lines, and traffic information posts; and prepare for the use of alternate routes in emergencies to insure safe and efficient traffic circulation to meet military requirements (FM 19-25).

Section II. PRINCIPLES OF MOTOR MOVEMENT

9. General

a. Organized military movements, as opposed to casual movements, are made by groups of

elements (troops and/or vehicles) over selected routes under supervision.

b. Military movements are organized to cen-

tralize control at the highest level at which it can be adequately exercised; to insure delivery of personnel, equipment, and supplies in accordance with established schedules and priorities; to maintain flexibility for meeting changing tactical situations; to use carrying capacity efficiently; to provide the maximum comfort to troops compatible with the situation; to facilitate distribution of cargo at destination; and to provide adequate security en route.

c. Organized motor movements generally include military movements either in the United States or overseas in any situation in which casual movements would prove impractical, inefficient, or unsafe due to the tactical or training situation, the size of the movement, or requirements for control.

10. Marches and Convoys

Organized overland movements of personnel, equipment, and supplies fall into the basic categories defined and explained below.

a. Marches are organized movements of troops as units under organizational command using organic or attached transportation. They are generally further classified as to the principal means, that is, foot marches or motor marches.

b. Convoys are groups of vehicles organized for purposes of security and control.

11. March Organization

March organization is influenced by a number of factors which include the assigned mission, regulations imposed by higher authority, type of transportation available, type of load or loads, highway and traffic conditions, tactical situation, and administrative conditions. Movements of larger units are normally organized in a number of march columns which are planned, coordinated, and controlled by a traffic headquarters. Such march columns, often moving simultaneously over different routes, permit operational flexibility to meet various conditions without sacrificing the tactical integrity of the parent unit. The following terms are commonly used in describing march organization:

a. *March Unit.* A motor march unit is a group of vehicles under direct control of a single commander using voice, visual signal, or radio. The size and composition of the march unit are

dependent on the situation and mission. Vehicles of different characteristics should not be placed in one march unit unless demanded by the tactical situation or mission.

b. *March Column.* A march column includes all elements using the same route for a single movement of troops. Thus a march column may include one or more march units or serials moving along one route under the order and the centralized control of a single commander.

c. *Serial.* A serial consists of elements of a march column moving from one area, over the same route, at the same rate, to the same new area, and grouped under one commander. It is organized as a single unit for the purpose of planning, regulation, and control and given a serial designation for convenience in scheduling, preparing, and issuing march instructions.

12. Organization of Columns

The organization of motor columns is normally prescribed in unit standing operating procedures. All motor columns, and organized elements thereof, are composed of three functional parts: the head, main body, and the trail. The commander, to insure the freedom of movement necessary to exercise proper command and control, has no prescribed place in the column.

a. *The Head.* The first vehicle of the column is marked with a blue flag or light and carries the subordinate commander known as the pace setter. From this position the pace setter maintains the prescribed schedules and rates of march, leads the column on its proper route, checks in at scheduled points, and receives orders or changes in orders, issuing instructions as required.

b. *The Main Body.* The main body is immediately preceded by the pace setter's vehicle and consists primarily of task vehicles carrying troops, equipment, and/or supplies. The main body may be subdivided into march units which may be grouped in serials for regulation and control. March units or serials will be similarly organized with head, main body, and trail.

c. *The Trail.* The last element of the column in order of march is the trail. The trail officer or noncommissioned officer represents the commander in such functions as the prevention of straggling, maintaining discipline, march maintenance of vehicles, medical aid, and checking

final clearance of the column at designated points. He takes such action as may be required in these matters.

13. Principles of Column Movement

Three general principles should be considered in planning and executing motor movements.

a. Upon approaching hills, curves, congested areas, or other traffic obstacles, the distances between vehicles decrease as the speed of the head of the column decreases. As the head of the column regains the open road and resumes speed, these distances increase. This natural accordion action must be recognized and appro-

priate measures of column control should be taken, particularly in hilly or congested areas.

b. The mobility and flexibility of a motor movement decrease progressively as the size of the column increases. The division of large columns into march units and serials reduces this loss of mobility by increasing flexibility of movement and control.

c. The road speed of a column or element of a column is limited by the capabilities of its slowest vehicles; therefore, vehicles of similar characteristics are grouped together whenever possible so that maximum road speed may be maintained.

PART TWO
MOTOR MOVEMENTS OPERATIONS
CHAPTER 3
OPERATIONAL CONSIDERATIONS

Section I. GENERAL

14. Operational Factors

The success of a motor movement is largely dependent upon a favorable balance of operational factors. These factors include terrain, weather, the tactical situation, availability and suitability of vehicles, and driver capabilities. Planning personnel anticipate and plan for meeting as many variations in these factors as may be foreseen, yet the final responsibility rests with the operating personnel.

15. Requirements for Successful Movement

The basic requirements for successful motor movement are suitable vehicles in the amounts necessary, an adequate road net, and well trained planning and operating personnel. The

thorough training of operating personnel is of particular importance since this may compensate for restrictions in either vehicles or high-way facilities imposed by combat conditions. Training in operational and control techniques under a variety of conditions will provide the skills necessary to make adjustments to high-way conditions, enemy actions, loss of facilities, or enforced imbalance in vehicular capabilities and requirements. Motor movements in the theater of operations are always subject to unexpected delays and sudden changes in plan. To minimize delay and confusion while adapting movement plans to the tactical situation, all routine problems of movement should be anticipated in the preparation of unit standing operating procedures.

Section II. THE MILITARY DRIVER

16. Driver Selection and Utilization

Commanders should constantly strive to select only men with the proper qualifications to be trained as drivers. Men with low intelligence, poor physical coordination, slow reaction, or little sense of responsibility should not be selected to be trained as drivers. The military motor vehicle is an expensive piece of mechanical equipment designed to give long, dependable service under military conditions if properly operated and maintained. Poor drivers cause

excessive vehicle deadlining which impairs the mobility of the unit, places an undue burden on maintenance facilities, and greatly increases the cost of military transportation. The good driver must not only know how to drive properly and how to perform first echelon maintenance but must also perform these duties skillfully and habitually. Drivers must learn to appreciate the value of, and necessity for, good driving and good maintenance. They must *want* to drive properly and to perform their maintenance functions thoroughly. Command responsibility

does not end with the selection of personnel who meet the required standards. The unit driver training program must be well conceived, progressive, and continuing, with adequate supervision to insure the maintenance of unit mobility (TM 21-300).

17. Driver Responsibilities

The military driver has two fields of responsibility—operation and preventive maintenance. Drivers operational responsibilities include the mechanical operation of assigned vehicles, observance of traffic laws and regulations, and alert adherence to military orders and instructions at all times to insure the smooth and efficient operation of military movements. The driver also supervises the loading of the vehicle, provides adequate protection from the weather, and properly lashes the load. Basic driver training imparts the required skills in actual operations, including making smooth starts and stops, selecting the proper gear ratios for various speeds and loads, and judging speeds and distances. This skill must be coupled with a knowledge of traffic laws and regulations to insure safe highway operation under normal conditions. Since a large percentage of military movements are made in formation, the driver also must be thoroughly familiar with the mechanics of column movements and control and must be prepared to comply with orders and instructions of the commander. By performing daily and other scheduled inspections and serv-

ices properly and reporting uncorrected equipment faults on DA Form 2404 (Equipment Inspection and Maintenance Worksheet), the driver makes it possible for organizational mechanics to correct faults before they necessitate major repairs. Many minor faults can be remedied by the driver on the spot. The driver also must be experienced in performing all these duties while wearing the field protective mask.

18. En Route Procedures

The smooth, uninterrupted movement of personnel, equipment, and supplies by motor is largely dependent upon the operation of individual vehicles. The driver must be thoroughly trained and oriented regarding the particular movement. His inspection and maintenance duties—before operation, during operation, at the halt, and after operation—insure the movement against unnecessary en route maintenance. His alert attention to instructions, to traffic laws and regulations, to column control signs and signals, and to the protection of load or cargo are important basic factors in motor movement. The driver should be familiarized with the route and should know the rate of march, the formation for the movement, and distances to be maintained between vehicles. He also should know the procedures and timing for refueling and messing and should be familiar with Standing Operating Procedures on medical care and motor repair on the march (TM 21-300 and TM 21-305).

Section III. HIGHWAY REGULATIONS

19. General

Highway regulation is normally a function of the highway traffic headquarters of the command. However, since this function has assumed major importance with the growth of mechanization in modern military organization, it is necessary for all concerned with highway movement to be familiar with the mechanics and techniques of highway regulation in order to comply intelligently with its provisions. The purpose of highway regulation is to coordinate the actual use of highways by troops, supply vehicles, refugees, and civilians to afford the best use of facilities in accordance with desig-

nated priorities. For further information see FM 31-60, FM 55-31, and FM 61-100.

20. Types of Control

a. Organizational Control. Organizational control is always exercised during highway movements. This control is the responsibility of the commander of the organization or unit using the road and, as prescribed by higher authorities, insures that rules of the road, traffic laws and regulations, speeds, spacing, routing, adherence to schedules, discipline en route and at halts, and measures for local security are observed.

b. Area Control. Area control of the highways is a function of command exercised under the general staff supervision of the G4. Regulation is prescribed by the highway traffic headquarters. Highway regulation controls are provided by highway regulation point teams. Highway traffic control provided by military police and, in certain circumstances, civilian police complements and enhances highway regulation. Area control is superimposed over organizational control and is the means by which highway movement is coordinated between units and organizations using the highways. It is employed only to the extent necessary to insure orderly and effective movement of vehicles over the highway system.

21. Control Classification of Highway Routes

In accordance with the degree of control demanded in the planning and operation of highway regulation, highway routes are designated by the following terms:

a. An open route is one over which minimum control is exercised. No "movement credit" (Standardization Agreement 2154) is required for the use of an open route. Supervision is normally limited to military police traffic control at critical intersections, enforcement of standard traffic laws and regulations, and the necessary signs and highway markings.

b. A supervised route requires limited control by a central traffic authority (highway traffic headquarters) using traffic control posts and patrols provided by appropriate military police units. A "movement credit" is required for any column of more than 10 vehicles or for any independent vehicle of exceptional size or weight. No prior correlation of individual march schedules is usually necessary for the use of the route by small units although access to the route may be regulated in conformity with the traffic situation.

c. A dispatch route, or (NATO) regulated route, is a road over which full control, both as to priorities of use and the regulated movement of traffic in time and space, is exercised. A "movement credit" is required for the movement of any vehicle or group of vehicles whatever the number or type. Normally a high degree of area control is required in addition to organizational control and military police traffic control.

d. A reserved route is a controlled route set aside for the exclusive use of a designated unit or specified type of traffic—a particular authority or formation, or intended to meet a particular requirement. When reserved for a designated unit, the commander of the unit decides the degree of regulation and control that will be exercised. In addition to organizational control, adequate military police traffic control is required to deny use of the route to unauthorized traffic.

22. Operating Procedures

a. Routing. Highway traffic is routed from origin to destination by the transportation service. Through traffic is routed by regulating the entire route by an intersectional service or by subordinate area commands following the established procedures of the highest command concerned.

b. Scheduling. Scheduling is the means by which priority of movement and traffic density are controlled and congestion is avoided. It is achieved by the regulation of departures from origin or points en route, the rates of advance en route, and arrivals at destination or points en route. Scheduling is a function of the highway traffic headquarters of the command having area jurisdiction.

c. Regulating. Highway regulation points are set up along dispatch routes to transmit orders to convoy commanders and to report progress of serials. Personnel of highway regulation points work in conjunction with military police.

d. Emergency Routing and Scheduling. Local adjustments of traffic routing and scheduling frequently are necessitated by changes in the tactical situation, damage to roads, weather, or traffic congestion. Under tactical conditions highway regulation point teams and military police assist column commanders to take the necessary immediate action with minimum dislocation or area motor movement operations. Movements must not be delayed awaiting orders from higher headquarters; the decision must be made by the column or unit commander. For more detailed information, see FM 55-31. When conditions are primarily nontactical, the column commander, military police, or highway regulation point team take action to reroute the column to avoid conflicts and keep the traffic flowing.

Section IV. COLUMN COMMAND AND CONTROL

23. General

Certain internal functions of march control are the normal responsibility of the personnel of the marching unit, while other functions of control are imposed on the unit by higher authority. The commanders of march units should have detailed knowledge of both in order to enforce their own directives and to insure intelligent cooperation with highway regulation and traffic control personnel. For more detailed information, see FM 19-25, FM 55-4, and FM 55-31.

24. Methods of Movement

A fundamental measure for column command and control is the selection of a method of movement suitable to the situation and the degree of control necessary. In many instances the formation of columns or convoys may be impracticable due to the need for dispersion or for avoiding interference with other traffic over a specific route. In other cases individual dispatch may not provide the degree of security, control, or unit integrity required to perform the assigned military mission. The commander must decide which method is best for the mission and situation. The three basic methods of movement are as follows:

a. Close Column.

- (1) *Definition.* A close column is one in which the elements are formed as compactly as practicable to reduce road space to a minimum. Vehicles follow at the shortest distances which safety, traffic conditions, and the tactical situation will permit.
- (2) *Uses.* Close column is employed when the road net must be used to its maximum capacity. It may also be employed for better control in movements through congested areas, in which case arrangements should be made for escorts. Close column is also often used in night movements under blackout conditions, particularly over poorly marked routes when it is essential that gaps between vehicles be short enough to enable drivers to maintain visual contact with the vehicle ahead.

- (3) *Execution.* Vehicles in each march unit will follow the vehicle ahead at a distance governed by a small speedometer multiplier (2 or 3) (par. 27a), sufficient only to insure against accident. On occasion, the casual "follow me" method of marching may be used. When this is done, drivers are instructed to follow the vehicle ahead as closely as they think is reasonable and consistent with safe driving practices (TM 21-305). The distance between successive vehicles (gap) is specified in meters—a minimum determined by stopping distances at the speeds allowed. A maximum speed is also prescribed for vehicles regaining lost distances. Changes in speed are accomplished smoothly and gradually to insure safety and uniformity of column movement. The head of the column maintains its position en route by the use of a time schedule or a minimum gap from the rear of the preceding unit. The at-halt gap may also be prescribed in the march order. (Unless the tactical situation prohibits congestion, vehicles within each march unit may close up to approximately 3 meters (yards) between bumpers at halts. March units and serials, however, should not close on the units ahead unless so ordered.)
- (4) *Advantages.* In close column the full traffic capacity of the road, or traffic lane, can be used because road space is reduced to the minimum which permits safe driving. Column control and intracolumn communication should be better in such compact columns, and fewer guides, escorts, and markers are needed.
- (5) *Disadvantages.* Close column formations do not provide dispersion for passive protection against enemy observation and attack. The strength and type of organization are readily apparent to hostile observation. Vehicles also may arrive at terminal

areas more rapidly than they can be handled without congestion. Careful scheduling and rigid control of traffic are necessary to avoid dangerous blocking at intersections. Greater driver fatigue is generally experienced in close column, and use of the highway by other traffic is severely limited.

b. Open Column.

- (1) *Definition.* An open column is a motor column in which the distances between vehicles are increased to afford dispersion.
- (2) *Uses.* Open column formations are employed to reduce the effectiveness of enemy observation and action, to permit the concurrent use of highways by traffic moving at various speeds, and to reduce driver fatigue, particularly in areas where dust is a factor.
- (3) *Execution.* Open column movements are normally accomplished by designating a large speedometer multiplier (3 or more), a greater minimum gap between vehicles (75–100 meters), or both. In areas particularly sensitive to enemy action or in areas of broken terrain, adequate dispersion may be further insured by prescribing traffic density in orders.
- (4) *Advantages.* Four basic advantages may be gained from the employment of open column formations. First, they offer passive protection from hostile observation and attack and minimize losses from enemy action. Second, open column formations allow greater highway speeds with safety (the use of a large speedometer multiplier gives more flexibility to the individual driver in meeting highway emergencies). Third, open columns permit a greater flexibility in highway utilization, both in planning movements and in making adjustments for sudden changes in the tactical situation. And fourth, a definite reduction in driver fatigue, both physical and psychological, results from the use of open columns.
- (5) *Disadvantages.* In comparison with

close columns, open columns are more difficult to command and control. Due to the large gaps between vehicles, drivers have difficulty in maintaining the prescribed spacing. Open column formations also permit less traffic volume on a road than more compact formations. In comparison with infiltration, open columns permit less secrecy and a lower degree of passive defense.

c. Infiltration.

- (1) *Definition.* Infiltration is the dispatch of vehicles over a route individually, in small groups, or at irregular intervals.
- (2) *Uses.* When sufficient time and road space are available, this formation is used to provide the maximum of secrecy, deception, and dispersion as a means of passive protection against enemy observation and attack. It is therefore well suited to daylight marches. It may also be used to execute a movement along a heavily traveled route on which it would be impracticable to impose a complete unit. Since infiltration produces a minimum of interference with other traffic and permits a higher average rate of march, it is suitable for movement in congested areas and on routes which cross heavily traveled roads.
- (3) *Execution.* Vehicles are usually dispatched individually, or in small groups, at a rate that will keep the average traffic density down and prevent the undue massing of vehicles. Every driver must be given detailed instructions regarding the route, running speeds, maximum speed, and restrictions before leaving the unit area. The route of march should be clearly marked and, if practicable, a strip map should be provided for each driver. Average distance between vehicles in the overall plan is determined initially by the rate at which vehicles are dispatched. Thereafter, speeds and distances are regulated by individual drivers in conformity with operating instructions. Deception for

the purpose of preventing the disclosure of a movement to enemy observers may be provided by intermingling various types of vehicles and by permitting passing within the march. In order to provide passive defense against enemy observation and attack, vehicles normally, should be dispatched so as to produce an average traffic density not to exceed 10 vehicles per kilometer. When more than one movement is taking place simultaneously over the same route, it is desirable to coordinate the rates of dispatch to obtain the desired dispersion. Supervision of movement is effected by stationing necessary regulation and control personnel along the route of march. To prevent massing of vehicles at or near traffic bottlenecks or the march destination, it is important that adequate guides or markers be posted so that vehicles may proceed with minimum delay.

- (4) *Advantages.* Infiltration provides the best possible passive defense against hostile observation and attack. Under light traffic conditions, movement of individual vehicles is not materially affected by other vehicles on the march but is limited only by the march order; road capability; vehicle mobility; and the training, experience, and physical condition of the drivers. Higher speeds by individual vehicles may be obtained by this type of movement. Since traffic density is light, cross traffic may move without excessive interference. A unit may be moved by infiltration over a route on which traffic is too heavy to move the unit at one time.
- (5) *Disadvantages.* Time length of the infiltration march is greater than with any other type of movement. Thus, in spite of a higher rate of march, the total road clearance time for a march may be longer. Because of extended distances between vehicles, internal control of the march is difficult. Drivers are usually unable to regulate their movements by the vehicle ahead. Therefore, careful mark-

ing of the route is necessary to prevent drivers from getting lost. If drivers operate alone, more detailed briefing is required, maintenance arrangements may be difficult, and refueling and messing are sometimes difficult to arrange. Since individual vehicles and small units operate separately and since other units may move simultaneously over the same route, there is danger that they may bunch up so that, although the average density per mile is as prescribed, there is a close column on one section of the road but no vehicles on other sections. Due to less control, the tactical employment of the unit may be difficult until the march is completed.

25. Start Point

a. Definition. A start point is a clearly defined point on a route at which motor movement becomes controlled by the commander ordering the move. The march column or element is formed by the successive arrival of its various march units at the start point.

b. Location. The start point should be so located that all march units move in the direction of the march, reach the start point, and take their places in column without reduction in speed and at proper intervals. It should be inconspicuous to hostile observation yet easily identified by those in the column in order to eliminate the possibility of confusion. In motor movements of larger units, several successive start points may be designated to facilitate forming the column.

c. Uses. The column commander assumes active control of the column at the start point, and scheduling of the movement is based on the start point. At this point the commander may make the adaptations necessary to compensate for delays of certain elements or for other unforeseen circumstances. The start point is also the position often used to check various convoys onto a dispatch route. As each vehicle passes the start point its driver or front seat passenger records the odometer reading to use in referring to points along the route in terms of mileage from the start point.

26. March Discipline

a. March discipline is attained through training and through internal control within the marching unit. It is indispensable to the effectiveness of the march column. The specific objective of march discipline is to insure intelligent cooperation and effective teamwork on the part of all march personnel. Such cooperation and teamwork can be attained only by thorough training, constant supervision by every officer and noncommissioned officer, practical experience in marching, and meticulous attention to details of technique listed below.

- (1) Correct driving.
- (2) Immediate and effective response to all signals and orders.
- (3) Prompt relaying of visual signals.
- (4) Strict obedience to traffic regulations; to rules of the road; and to the instructions of highway regulating, traffic control, and command personnel.
- (5) Effective use of cover, concealment, camouflage, dispersion, radio silence, blackout precautions, and other protective measures against air, ground, or CBR attack.
- (6) Correct speeds, distances, and positions within the column.
- (7) Observance of the rules of march hygiene.
- (8) Proper care of equipment.
- (9) Observance of proper safety precautions at the halt.

b. The responsibility for good march discipline begins with the driver of each vehicle and increases with each commander charged with internal control.

- (1) The driver of each vehicle is responsible for observing the proper distance and speed, for safety precautions, for good driving, for performance of prescribed first echelon maintenance, and for strict observance of all requirements of standing operating procedure or specific orders governing the march. The driver will be given adequate orientation on

routing and destination to insure safe arrival in the event of separation from the column. When time and facilities permit, he should be supplied with a strip map of his route.

- (2) The assistant driver should be constantly on the alert for column signals and warnings and for signs placed along the road. He warns the driver and transmits such information back along the column when appropriate. This is particularly important at night or under conditions of poor visibility. The assistant driver should assist the driver in every way possible. This includes guarding against his falling asleep, assisting in at-halt maintenance service, and helping with emergency repairs.
- (3) Squad leaders supervise the actions of the drivers of the vehicles assigned to their squads, giving particular attention to spacing of vehicles and the performance of first echelon maintenance.
- (4) Section leaders and platoon leaders supervise the actions of squad leaders, giving them the instructions required for the proper functioning of their sections or platoons.
- (5) The march unit leader or commander gives the orders to move or halt and exercises general supervision over the conduct of his unit. He is responsible for maintaining the proper position of the march unit within a larger column and for carrying out the orders of the column commander.
- (6) Commanders in a convoy, column, or serial are responsible for their units. This responsibility becomes broader and more general at each higher level of command.

27. The Speedometer Multiplier

a. The speedometer multiplier offers a convenient method of designating and maintaining appropriate gaps between vehicles in column

under varying conditions of traffic and terrain. The use of the speedometer multiplier for column control facilitates the continuous movement of the column over difficult terrain, through congested areas, and around obstacles by variation of gap and lead in direct proportion to speed. The controlled accordion action thus produced allows the maximum use of the better sections of the route, while reducing delay at difficult sections. The speedometer multiplier is a number selected on the basis of a minimum desired gap between vehicles at the lowest speed anticipated. It is expressed as 2, 3, or higher. The indicated speed of the vehicle in kilometers or miles per hour is multiplied by the specified speedometer multiplier. The result is the required gap in meters or yards between vehicles at that speed. Thus, at 25 kilometers per hour with a speedometer multiplier of 3, the gap is about 75 meters. Since gap and lead fluctuate in direct proportion to speed, the column will close smoothly as the speed is reduced and will open as normal speeds are resumed. Therefore, only those vehicles actually traversing the difficult section of highway will be traveling at minimum speeds, while the speed of the remainder of the column is affected as little as possible.

b. For movements in areas where road conditions are extremely variable, a minimum gap must be specified (in the standing operating procedures or elsewhere) to prevent bunching of vehicles at slow speeds. The selection of an abnormally large speedometer multiplier to give the required gap and lead at slow speeds, however, may result in a lack of column control at high speeds. Care must also be exercised in specifying the minimum gap for the use of any column or march element to insure against producing time lengths at reduced speeds that will prevent clearances as scheduled in orders.

c. The use of the speedometer multiplier in the control of motor movements is limited by the degree of security indicated by the situation. Because the use of the speedometer multiplier alone sacrifices the element of dispersion at reduced speeds, other means of column regulation and control are normally used when there is probability of enemy interference. Movements involving small units or convoys over average

terrain and administrative or supply movements in rear areas, however, may use the speedometer multiplier to advantage.

28. Control Identification of Vehicles

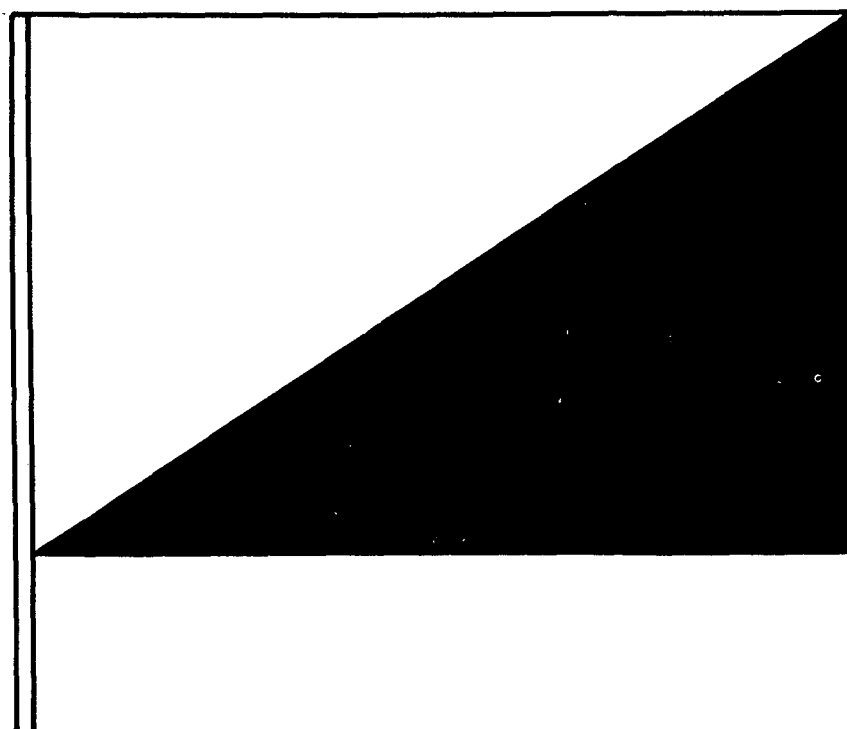
It is desirable to mark or otherwise designate vehicles of the column for control purposes. Such identification is subject to local conditions and is usually specified in standing operating procedures. Marking should be kept to the minimum consistent with its need in column control and in conformance with AR 746-2300-1 and international agreements. Temporary markings should be easily removable.

a. *Unit Flags and Symbols.* Security permitting, headquarters vehicles of companies or similar units may display guidons. Message center vehicles of battalions, battle groups, or similar units may be indicated by distinctive symbols or panels displayed on the front, rear, top, or sides. When necessary for security reasons, guidons should be cased and symbols or panels covered or removed.

b. *Cloth Control Indicators.* Control cars of columns may be indicated by flags or other markers attached to their front or rear. The standardized markings recognized by international agreement will be employed. These markings and their uses are specified in AR 746-2300-1 and in STANAG 2027, NATO Standardization Agreement—Marking of Military Vehicles. This agreement defines a movement serial as an element or group of elements within a series which is given a numerical or alphabetical designation for convenience in planning, scheduling, or control of movement. Specifications for flags and their use are as follows:

- (1) The leading vehicle of each movement serial will carry a blue flag.
- (2) The rear vehicle in the movement serial will carry a green flag.
- (3) The vehicle of a movement serial commander will display a white and black flag as indicated below.

(Example)



- (4) Flags should be approximately 30 cms x 45.7 cms (12" x 18").
- (5) In areas where vehicles drive on the left side of the highway, flags are mounted on the right side of the vehicle. Otherwise, they are on the left. They may be at either the front or the rear of the vehicle, and they should be positioned so they will not interfere with the vision of the operator or crew, the lights, or any functional component of the vehicle.

c. Numbering of Vehicles. The number or letter assigned to a movement serial is marked on the front and both sides of each vehicle in the serial. The serial marking must be clearly visible from the ground and must not conceal other prescribed markings. Individual vehicles within the main body of the column may be numbered in sequence to facilitate formation of the column and identification of individual vehicles. Such numbers may be drawn on the sides and bumpers of vehicles with soft chalk crayons or indicated by prepared signs.

d. Special Markings on Vehicles. In addition to the markings previously described, standard markings are prescribed for vehicles which require easy identification.

- (1) Vehicles carrying general officers will be marked with the appropriate conventional symbol on a plate attached to the right end of the front bumper and to the left end of the rear bumper (AR 746-2300-1). Flags indicating the rank or function of general officers may be flown.
- (2) Armed forces police vehicles and military police traffic control vehicles are marked prominently in accordance with paragraphs 18 and 19, AR 746-2300-1.
- (3) Ambulances and other vehicles provided exclusively for medical purposes are marked in conformity with the rules of the Geneva Convention.
- (4) Vehicles of bomb disposal units will have all mudguards painted red.
- (5) A red flag flown from any vehicle indicates danger.
- (6) Vehicles which for any reason require priority over all other vehicles may be marked by an equilateral triangle of red border lines on a white background and with red symbols displayed on the front and rear of the vehicle. This marking may be pre-

scribed by any commander having area responsibility and is valid only in the area of the commander concerned. The symbol inside of the triangle will indicate the commander authorizing the use of this priority sign.

e. Air/Ground Recognition Markings. As prescribed by theater commanders, red and yellow fluorescent air/ground recognition panels may be draped on vehicles in a standard unchanging pattern which will be different from the displays prescribed for other recognition services.

29. Communications Control

Adequate communication within the column is essential to efficient command and control. The column normally is organized to facilitate communication by the means available. Unit standing operating procedure may designate the means and their use under specific circumstances. The use of rotary wing aircraft, when the conditions permit, will greatly facilitate column control as indicated below. The march order specifies security limitations. Methods of intracolumn communication include the following:

a. Visual Signals. Visual signals are most commonly used for column control. These may be arm-and-hand, flashlight, or flag signals. They may be given directly by the commander to the entire march unit or may be relayed from vehicle to vehicle as in the case of standard drivers signals. Visual signaling is easily understood, rapid in transmission, and covers all the basic column maneuvers such as starting, stopping, changing speed, and changing direction.

b. Audio Signals. The use of sound is an elemental communication method and continues to be used, mainly in conjunction with other means of signaling, for column control. Whistles, horns, or bugles are used to attract attention, to warn personnel of further transmission of commands, and to spread alarms. Voice commands and verbal messages are classed as audio signals and are used when the situation permits. Aircraft equipped with loudspeakers may be used for this purpose.

c. Radio Communication. When communication security permits and when vehicles are adequately equipped, radio is the principal means of communication during a march. Radio

supplies the most rapid transmission of orders and messages between widely separated element of a column. Its use is generally specified in orders, in unit standing operating procedures, and in signal operation instructions. Aircraft may be used to relay messages between FM radios on the ground in terrain that restricts direct communication.

d. Other Methods. Sign messages, written on a board and posted along the route or displayed by a guide in view of oncoming vehicles, are often used to pass instructions along the moving column. When this method is used, signs are posted from the head of the column and picked up as the rear of the column passes. Messages written on message blanks may be delivered by guides along the route or by messengers. The use of messengers along a moving column is limited by traffic and by the type of vehicles available. Written messages, orders, and overlays are usually delivered by messengers at scheduled halts. The use of aircraft for the delivery of messages or of control personnel to locations along a congested route is both practical and effective since the time element is reduced and no additional ground vehicles add to the congestion.

30. Column Commander

The officer or noncommissioned officer in command of a convoy is responsible for all that occurs in his unit. He issues the necessary orders to initiate the march and takes whatever action necessary to insure that instructions contained in standing operating procedures and in march orders are adhered to during the preparation for, and conduct of, the march. He must be free to go wherever he may be required to supervise the movement of his command. A competent representative of the commander is placed at the head and another at the trail to act in his absence. The commander makes the decision as to his own position in the column based upon consideration of anticipated problems and the location most suitable for their solution. When conditions permit, the use of light aircraft with the necessary communications equipment will greatly facilitate column control. From the air the commander or his representative can easily note deviations from the prescribed formation, changes in traffic conditions, and errors in following the designated route and can take cor-

rective action without delay. Air reconnaissance, concurrent with aerial column control, may also enable the commander to make timely adjustment to plans to meet changing situations.

31. Control Officer or Noncommissioned Officers

Column control is maintained by command and staff personnel at all echelons within the column. Commanders of serials and march units are responsible for the operation of their respective commands, each using his staff or representatives to assist as he may direct. The unit executive officer may be designated to regulate the rate of march, insuring adherence to the prescribed schedule and arrival at designated control points on time. He is also usually responsible for notification to higher headquarters of any unavoidable delays or proposed changes in plan. Unit staff officers are usually assigned specific supervisory duties for the movement in consonance with their normal staff functions.

32. Other Control Personnel

Depending on the size of the column and the requirements of the situation, control personnel may include the following:

a. Guides. Guides direct a unit or vehicles over a selected route or to a selected locality. They may either lead a unit or direct it from a stationary point. They may be members of the escort party or members of the organization who are familiar with the route or who have been instructed as to the direction to be followed.

b. Escorts. Escorts accompany a column or convoy to facilitate its movement and to protect it from interference. The composition of the escort varies with the situation and anticipated problems of movement. They may consist of military police, civilian police, or other personnel assigned to accompany the column through congested areas or areas of possible traffic conflict; of armed guards, ground troops, or armed aircraft to protect the movement from sabotage, guerrilla activity, or enemy action; or any required combinations of the foregoing.

c. Patrols. Patrols usually consist of military policemen in highly maneuverable vehicles. They are used in area control to provide liaison between key regulation or control posts, and provide frequent checking of critical points

on the road net where traffic blocks or bottlenecks are most likely to develop. On occasion they may precede a column to stop or otherwise direct conflicting traffic, in which case they assume the functions of escorts. Their purpose is to facilitate movements in accordance with the traffic plan and the schedules prescribed by the highway traffic headquarters having area jurisdiction or higher authority. They keep traffic moving and, as necessary, take emergency action to restore a plan which has been temporarily disrupted. Under organizational control, these duties are performed by personnel detailed from the unit making the move. Under area control, these duties are usually performed by military police detailed by the headquarters responsible for highway traffic control in the area.

d. The Advance Officer. The advance officer is designated by the commander to precede the column by sufficient distance to reconnoiter the route of march, selecting alternate routes or detours to negotiate road blocks or traffic jams without undue delay; to instruct and post organizational traffic control personnel; to post guides or markers where necessary; to notify the proper authorities of the approach of the column; and to check at highway regulation points for instructions or changes in instructions for the movement of the column when traveling on a dispatch route. The advance officer may also command a detachment sent forward for quartering, pioneering, and other details. He maintains communication with the commander by radio or other means to advise him of developments and to receive further orders or instructions.

e. Pace Setter. The pace setter is normally the chief control officer of a column or element thereof. An experienced officer or noncommissioned officer, often the unit executive, is designated by the column commander to act as his subordinate commander and to discharge those control duties outlined in paragraph 12c.

f. Trail Officer. The trail officer marches at the rear of the column or element thereof. An experienced motor transport officer should be selected for this duty. He is normally charged with such control responsibilities as checking vehicles, march units, or serials at the point of origin or at the designated start point; posting necessary guards, warning flags, caution lights,

or flares to warn traffic approaching from the rear when the column halts; picking up and, as soon as practicable, returning to the head of the column all guides and markers distributed by preceding elements; and preventing interference with the movement by traffic from the rear. He will also be alert to excessive accordion action, weaving, or other indications of a lack of discipline or of driver fatigue in the column and take appropriate action. In the event of an accident, he will see that the injured are cared for, summoning medical aid if necessary; accident reports properly completed; and preliminary investigations initiated. He also is responsible for the decision to leave vehicles behind.

g. Trail Maintenance Officers. Trail maintenance officers, as available for each march unit or for the column, ride at the rear of their units with the maintenance personnel and equipment and take action within the limits prescribed by the march order to maintain vehicles in serviceable condition. They should be familiar with the ordnance support plan for the area, including location of ordnance units, operation of ordnance road patrols, and current procedures for contacting the appropriate ordnance support available for maintenance and recovery assistance (FM 9-3). At halts, they proceed along the column to inspect vehicles and supervise maintenance operations. In small columns the duties of the trail maintenance officer are usually combined with those of the trail officer.

33. Completing the Movement

The successful accomplishment of the movement mission is achieved only upon the arrival of personnel, equipment, and supplies at the destination in condition for and suitably distributed to support the next operation. Arrival of the head of the column at the release point marks the beginning of the final phase of the movement. A release point is a location at which specified elements of a column or convoy revert to the control of their respective commanders. On reaching this point the serial or march unit is accounted for, separates from the column and, led by guides from the quartering party, moves promptly into its assigned area. In the case of large movements, successive secondary release points may be designated for successfully smaller elements. To insure the smooth, continued movement of elements past the release point and to guard against traffic congestion and confusion, adequate reconnaissance and organization of the area must be made prior to the arrival of the column. The posting of guides, selection and preparation of routes, and allocation of areas to specific elements may be done by advance details and will enable the column to clear the route without halting or obstructing the flow of traffic. In tactical situations the rapid distribution of vehicles and loads, early camouflage action, and elimination of noise and confusion through adequate organization and discipline may easily be the critical factor of the entire operation.

Section V. ADMINISTRATION AND MAINTENANCE EN ROUTE

34. General

Administration and maintenance en route are functions of motor movement that must be well planned and efficiently executed to insure the success of the operation. These functions normally are associated with scheduled halts. Adequate troop training and the development of unit SOP's will facilitate administration and maintenance en route.

35. Halts

Halts are made for purposes of rest, personal comfort and relief, messing, refueling, main-

tenance and inspection of equipment, allowing other traffic to pass, and for the adjustment of operational schedules.

a. Time, Duration, and Frequency. The time and duration of halts as well as their purpose are usually prescribed in orders from higher headquarters. A halt of 15 minutes is normally made at the end of the first hour. Halts of 10 minutes are often made after each 110 minutes of running time. Under conditions of extreme cold on marches longer than four hours, halts should be made every hour. One-half hour to one hour is generally allowed for mess and re-

fueling halts. When it is known to be necessary to allow others to pass, a mess and refueling halt should be scheduled to coincide with the passing thus utilizing necessary delay to advantage. To maintain proper gaps between serials it is necessary that all elements halt at the same time. In case of radio silence or where intra-column communication is inadequate, the time of each halt may be scheduled in orders.

b. Location.

- (1) The locations for scheduled halts should be selected in advance, specifically ordered, and plotted on road movement graphs (par. 94). These selections may be prescribed by higher authority, made tentatively by map reference, or made by the reconnaissance party. On dispatch routes, highway regulation points may include refueling stations, messing facilities, temporary quarters, and maintenance facilities. When such facilities have been provided, highway regulation orders or other orders from higher headquarters usually prescribe the places at which halts will be made.
- (2) If the halt is brief and will not interfere with normal traffic flow, the column may stop on the shoulder of the road. It is desirable that halting places provide turnaround facilities or circuitous exits so that the column can be reversed quickly or can re-enter the route conveniently.
- (3) If crossroads, railroad crossings, or similar danger points lie within the halt area of a column, subordinate commanders will require vehicles to stop a reasonably safe distance from them. No part of a column should stop on bridges, and halts on steep grades and sharp curves should be avoided.
- (4) Comfort of personnel and servicing facilities for vehicles are important considerations in selecting sites for long halts. If a column starts from a populous area, its first halt should be delayed, when practicable, until a rural area is reached. For the same reason halts should not ordinarily be made in villages or towns unless there is a special need.

c. Precautions at Halts.

- (1) Columns should be halted at points providing a clear view of more than 200 meters to the front and to the rear. If conditions prevent this, steps must be taken to forewarn approaching traffic.
- (2) Guards, warning flags, caution lights, or flares (security conditions permitting) should be posted at the front and rear of the column and at any other points where there is a hazard to passing traffic. If the column blocks part of the road at the halt so that it is necessary to operate one-way traffic, authorized traffic movements may be alternated either by using flags transmitted from one end of the single lane to the other by the last vehicle of each passing group or by posting guards to control traffic by signal.
- (3) When the halted column forces traffic moving in the same direction to cross the center line, vehicles should be parked with enough distance between them to allow passing vehicles to enter the column upon the approach of vehicles from the opposite direction.
- (4) Unless otherwise prescribed, when traffic approaches from the rear of the halted column and cannot clear the column before its resumption of movement, officers may require such traffic to remain behind until it is safe to pass.
- (5) All personnel other than traffic guides must remain off the road to the right of their assigned vehicles, keeping the traveled portion of the road clear at all times.

d. Duties at Halts.

- (1) Officers and noncommissioned officers check the welfare of personnel, the security of loads, and the performance of first echelon maintenance.
- (2) Control personnel make necessary inspections and give instructions to insure prompt resumption of the movement with a minimum of confusion at the end of the halt.
- (3) Mess, medical, and maintenance personnel perform such special duties as

the purpose and duration of the halt permit.

36. Messing en Route

Messes en route may be provided by organizations in the column or from facilities set up at highway regulation points or other centers on heavily traveled routes.

a. Organizational Messes. Unit kitchen trucks may either travel in the column with their respective organizations or be dispatched ahead of the movement to provide mess facilities en route. So far as conditions permit, mess personnel riding in the kitchen trucks begin preparing meals while the column is in motion in order to shorten time required at the halt. Careful supervision of field sanitation is particularly necessary when mobile kitchens are used since sources of food and water contamination are multiplied and troops tend to become careless in areas that they expect to occupy only briefly. The success of organizational messing en route is dependent upon the training, skill, and ingenuity of mess personnel. This type of mess has the advantage of being able to feed troops at regular intervals independent of routing.

b. Mess Stations. On dispatch or other regularly used routes, messes may be set up by personnel stationed along the route. These messes are particularly suited to convoys on a regular, established line haul and to personnel movements made without tactical organization. Mess stations must be notified sufficiently in advance to enable them to have the required quantity of food at the scheduled hour.

37. Maintenance

Maintenance en route is performed by the driver of the vehicle and trail maintenance personnel. The driver performs normal during-operation service en route, investigating and correcting or reporting faults detected during operation at each scheduled halt. He also makes such roadside repairs as fall within the limits of his training and capabilities. These repairs may include changing tires, tightening loose parts, and making minor repairs to fuel, electrical, and cooling systems. The driver should not attempt repair unless he is reasonably certain of his diagnosis of the trouble and of his ability to correct it. Unnecessary tampering with

mechanisms is prohibited. At the first opportunity after an emergency repair has been made, the driver should report the facts to his squad or section chief so that proper action may be taken. In cases where repairs or adjustments are beyond the capabilities of the driver, the trail maintenance officer makes the decision on the procedure to be followed, contacting appropriate ordnance support units if necessary. Diagnosis is made by trail maintenance personnel. If the necessary repairs are minor, a mechanic with tools and necessary parts is dropped off to make the repairs and rejoin the column later. If doubt exists as to repair within a reasonable time, the cargo or tow may be temporarily transferred to another vehicle to proceed with the column until the repaired vehicle rejoins. In any case the driver remains with his vehicle unless directed by competent authority to abandon it. Vehicles undergoing repairs and abandoned vehicles are placed off the road so that they will not interfere with traffic. When necessary repairs have been completed, the vehicle resumes the march at the maximum permissible speed, rejoining the rear of the column. At the next authorized halt the driver takes his normal place in column if road and traffic conditions permit.

38. Accident Procedures

The following accident procedures are those normally required regardless of the location or circumstances. They may be followed in the case of damage or casualties resulting from enemy action as well as those caused by carelessness. However, deviations may be necessary for certain situations.

a. Column Continues March. The main part of the column does not stop to render assistance. Every effort is made to clear the route and continue the march. However, a serious accident may block a part of the convoy or make it advisable for a small convoy to be halted. Such halts should be made far enough from the scene of the accident to prevent further congestion and mishap.

b. Trail Gives Assistance. Vehicles to the rear pull around the accident. If the accident blocks the route, the occupants of vehicles in the rear assist in clearing the route and proceed with the march as soon as a passage is cleared. If immediate assistance is required for injured

personnel, this aid is rendered by personnel of the next following vehicle. The next officer or noncommissioned officer to the rear will take control of the situation, rendering emergency aid and directing traffic until the trail officer, medical officer, or other competent assistance arrives. The necessary measures for the care of the injured, salvage or disposition of vehicles and cargos, and complete clearance of the route are normally carried out under the direction of the trail officer, aided by medical, maintenance, and salvage personnel.

c. Precautions Against Further Accidents.

- (1) After a motor vehicle accident the vehicle or vehicles involved are frequently in dangerous locations and a crowd may collect in the road. This situation may cause another accident more serious than the first if another vehicle crashes into the wreck or hits persons in the crowd. Immediate action must be taken to warn traffic to proceed with caution. Guards, flares, lights, or flags may be posted in keeping with the situation. Civil or military police, if present, will control traffic; otherwise, personnel should be detailed from the column for this purpose.
- (2) Traffic control personnel restore normal traffic movements as soon as possible. When they do not block important traffic, damaged vehicles are left undisturbed to assist the investigating officer in determining how the accident happened. Witnesses also should remain at the scene of the accident to provide information for the investigating officer if the military situation permits. All others are kept away and traffic is kept moving.

d. Aid to the Injured. Basic first aid, in which all military personnel are trained, may be rendered by those first arriving on the scene of the accident. However, it is important not to move the injured unnecessarily and to summon competent medical personnel immediately. In cases where there is danger from fire or explosion, the injured must be moved to safety immediately, regardless of the absence of medical personnel.

e. Precautions Against Fire. In all motor vehicle accidents there is a great danger of fire

due to gasoline leakage. To minimize this danger, engines should be cut off immediately and smoking and open flames should be prohibited near the wreck.

f. Notifying Authorities.

- (1) Normally all accidents which result in injury to an individual or animal or in damage to property are reported to the column commander or designated staff officer without delay, and to the military police of the nearest military installation.
- (2) Most civil governments require that police be summoned in cases of motor vehicle accidents. The Army cooperates with civil authorities in the United States and friendly countries in such matters. If civil police are not on hand, they should be notified.
- (3) Accident investigation agencies are summoned in accordance with current instructions. Policies on the investigation of accidents may be modified by the tactical situation, the area SOP, or applicable agreements between military and civil authorities. For further information, see FM 19-25.

39. Medical Service

Medical service should be provided for every motor movement. The type and amount of medical service needed to support the movement will depend on the situation and on the type and size of the march or convoy. This service may be organic to the unit or units in the movement, attached by higher headquarters, or provided by the area command in the form of medical aid stations located along the route. Evacuation will normally be to the nearest medical treatment facility. Movement orders should provide locations of medical treatment facilities along the route of movement. Medical elements organic to a unit should accompany it; normally, ambulances and medical personnel travel at the rear of the march unit or serial. In large columns, medical elements are dispersed throughout the column to minimize delay in cases of emergency. In small columns, medical service may be limited to medical aid men or motor vehicle first aid kits. This often requires special requisition to supply even minimum needs. The status of first

aid equipment should be determined by inspection well in advance of the movement. While TOE units traveling in tactical groupings will usually have adequate organizational medical

personnel and equipment, it is the responsibility of column commanders of other movements to insure necessary medical personnel and equipment to protect their commands.

CHAPTER 4

MOTOR MOVEMENTS IN THE THEATER OF OPERATIONS

Section I. GENERAL

40. Considerations

All training in military motor movements has as its ultimate objective the successful movement of troops, equipment, and supplies to support tactical operations in combat. It is therefore of primary importance that all military personnel know and recognize the problems associated with movements in the theater of operations and the accepted procedures and techniques used in their solution. As mobility requirements increase, the problems of successful movement grow in number and complexity. The problems of traffic regulation and control naturally increase in proportion to the traffic load on existing road nets. The physical limitations of highway facilities, possible damage to roads and bridges, and disorganization of civil government are factors which add to the basic problem of rapid movement of troops and supplies to support tactical operations. With the introduction of mass destruction weapons, the speed with which troops, equipment, and supplies can be concentrated or dispersed at the will of the commander may be the deciding

factor in the outcome of the operation. No movement of significant proportions may be considered safe from hostile interference. Enemy capabilities, including sabotage and guerrilla attack as well as air, artillery, and missile damage must be considered in both the planning and execution of all movements.

41. Characteristics of Military Traffic

Military traffic consists largely of movements of groups of vehicles having a common mission. Civilian traffic is usually the movement of vehicles having limitless variations of origin and destination. There is a considerable amount of casual military and civilian traffic in areas of military operations which is essential and cannot be disregarded. The flow of military traffic is subject to large, erratic, and often unpredictable changes and may be interrupted by traffic jams and bottlenecks of varying duration. Such changes and interruptions may occur with little or no advance warning.

Section II. ADMINISTRATIVE MOTOR MOVEMENTS—PERSONNEL

42. General

a. Since it normally is desirable that troop units be kept together, motor columns transporting personnel are often larger than supply convoys, which may more readily operate as small march units or serials. However, while columns of an administrative troop movement are often much longer than those of supply convoys, they are nevertheless separated into march units corresponding as closely as practicable to

the smaller units making up the troop organization.

b. Two units, the unit being transported and the truck unit furnishing the transportation, are frequently involved. It is therefore essential that the functions and restrictions on each be clearly delineated and that command responsibilities for the conduct of the movement be understood and observed.

c. When personnel are being transported, some of them may be detailed to guide, guard,

reconnaissance, or security duties. This presents a command problem in the delineation of responsibilities for the conduct of the movement.

d. It is important that all officers have knowledge of the general principles of highway transport movement. Movement by highway must operate under a thoroughly coordinated system. The effectiveness of troops depends not only on their own movement but also on the movement of supplies, and understanding of both types of movements is, therefore, important.

43. Command

a. Personnel movements require close coordination between those in command of the transportation and those in command of the troops being transported.

b. Personnel movements by motor vehicle include—

- (1) Those made in vehicles which are organic to the unit being transported.
- (2) Those made by means of truck units attached or assigned to the unit being transported.
- (3) Those made by means of Transportation Corps truck units, operating as part of the general hauling service provided by the highway transport service and not assigned or attached to the unit being transported.

c. When a unit is being transported in its organic vehicles, the troop commander has full command of both the personnel being transported and those operating the vehicles.

d. The commanding officer of a unit to which a truck unit has been assigned or attached by proper authority exercises command over the truck unit through its commanding officer.

e. When a truck unit is not assigned or attached to the unit which it is transporting but is merely providing the transportation service required, command of the convoy and of each serial or march unit remains with the truck unit commander and his representatives at their respective levels. In this case the commanding officer of the troops being transported (troop commander) retains full command of his troops and issues any orders necessary to conform to and implement those issued by the convoy commander as to schedules, march discipline, and operation of the convoy. The troop commander

should no more interfere with the operation of the convoy than he would with the operation of a troop ship or railroad train if his troops were so transported. However, if a tactical emergency requires it, the commander of troops being transported, regardless of rank, will assume command of the convoy and issue such orders as may be necessary to meet the emergency. In so doing, the troop commander should realize that the convoy commander may be proceeding under orders which are a part of a closely integrated schedule and that unnecessary changes in any part of the schedule may seriously impair the operation of the larger plan. The troop commander must accept full responsibility for any action which unnecessarily interferes with the overall highway schedules.

44. Command During Movement

a. The senior officer or noncommissioned officer of the troops in each truck commands the personnel transported in that truck. He is responsible for their discipline and for their compliance with the existing convoy regulations.

b. The driver of the vehicle, or the senior officer or noncommissioned officer of the operating personnel, is responsible for compliance with the schedule and operating instructions. He is responsible for safe operation of the vehicle and is required to insure that personnel being transported observe safety, sanitary, and other regulations. Regardless of rank, he will insure that the senior officer or noncommissioned officer of troops is familiar with applicable safety instructions.

c. While the senior officer of troops should not interfere with the proper operation of the vehicle and should conform to all suitable instructions of the operating personnel, it is his duty to take immediate corrective action in case of any derelictions on the part of operating personnel and to report them to the appropriate superior.

d. At the lower levels of command, these principles apply whether the movement is by organic vehicles, by attached Transportation Corps truck units, or by independently operated Transportation Corps units. In each case, certain personnel are charged with responsibility for the movement. They operate under definite plans, and officers and noncommissioned officers

of troops being transported should conform to the orders issued under those plans.

e. In individually dispatched vehicles, the senior passenger is responsible for seeing that the driver obeys laws, regulations, and instructions—usually published on a card carried in the vehicle.

45. Methods of Movement

a. *Full Lift*. When sufficient truck units are available or when the troop unit is completely motorized, the entire movement may be accomplished in one lift.

b. *Point-to-Point Shuttle*. Truck units may shuttle back and forth from point to point, taking a portion of the troops on each trip, until the movement is complete. Unless the situation is well in hand or can be met by the first troops transported, this method is not usually used in tactical movements when additional transportation is available from higher headquarters.

c. *Leapfrog Shuttle*. Leapfrog shuttle is perhaps best adaptable to tactical troops while making advance or retrograde movements in combat or in close support of combat operations. It is a variation of the point-to-point shuttle and may be varied to meet the situation. It may be demonstrated by the movement of two units of a single command. From one position, a unit moves, establishes, and holds another position. When this position has been established, the vehicle return for the second unit. Instead of taking them to the position established by the first, they carry them past, where they establish a third position. Then the vehicles return to the first unit and carry it past the position established by the second. This operation is repeated until the troops arrive at their final destination. This method allows the movement to continue uninterrupted while adequate positions are maintained.

d. *Part-Ride, Part-Walk Shuttle*. This method uses a limited number of vehicles in speeding the continuous forward movement of foot troops. A part of the unit entrucks at the start of the march and is carried to a selected point along the route where troops dismount and proceed on foot. The trucks return for the balance of the unit, which, meanwhile, has started the march on foot. This method enables all elements of the unit to arrive at the destination at the same time, each having performed an equal portion of the march on foot.

46. Considerations in Loading

The primary objectives of administrative movements are comfort and convenience of personnel, rapid transit, and the most efficient use of available transportation. Complete attainment of these objectives must be compromised by consideration of the situation. Complete security in the theater of operations can seldom be assumed. In most cases, troops will carry arms and ammunition to provide some degree of protection against attack. Security duties are, therefore, assigned to personnel even though vehicles may be loaded to their maximum capacity consistent with personal comfort and without regard to tactical organization. When troops are being transported to build up reserves in a rear area or as casual movements of replacements, and where the possibility of interference by the enemy is remote, supplies and equipment can often be transported in separate vehicles or in a separate convoy preceding or following the personnel convoy. Small trailers are useful for transporting individual equipment in personnel convoys composed of light trucks.

47. Entrucking Procedures

a. An entrucking point is selected which will require a minimum of marching by foot troops and a minimum of movement of supplies and equipment, which affords adequate area for the method selected for entrucking, which presents no undue obstacles to the movement of vehicles, and which offers ready access to the selected route of march.

b. When time and space allow, the troop commander may ascertain the exact makeup of the motor column which will transport his unit, the exact capacity of each vehicle, and the exact gaps between vehicles as they halt for entrucking. The troop commander then forms his command in parties corresponding to the location and capacity of each vehicle. At the prescribed hour, the troop commander forms his unit in line or line of columns along the line of march of the vehicles, with intervals corresponding to the gaps between vehicles at the halt. On command, all troops mount their assigned vehicles simultaneously. This is by far the quickest method of entrucking, but it requires careful planning and adequate space for trucks and troops.

c. When time and space are not adequate for the method of entrucking described above, the trucks may be parked and the troops marched alongside in single file or column of twos or threes, and counted off into vehicle parties. Each party is then led to its proper vehicle. Although this method may be somewhat slower, it is the easiest and most practical method under many conditions.

d. A combination of the two methods may be used for general troop loadings by assigning each section, platoon, or company to a selected number of trucks. Then, upon command, all units are marched simultaneously alongside their assigned trucks. Each platoon or section leader counts off his men into parties as they mount the assigned vehicles.

e. The driver of each vehicle is responsible for unfastening the safety strap and lowering the tailgate before personnel are permitted to mount the vehicle. After all personnel have mounted, the driver closes and secures the tailgate and fastens safety strap.

48. Loading of Individual Equipment

a. Packs, other than combat packs, normally are not worn in military vehicles. Usually it is desirable to have troops board the vehicles with their packs on and then take them off, stacking them on the floor between or under the seats.

b. Duffel bags may be loaded on vehicles with the men to whom they belong. This procedure reduces the number of men who may occupy the vehicle with comfort, but lessens the probability of loss of equipment.

c. All items of individual equipment not needed on the march may be loaded in separate trucks or trailers. This relieves the troops of responsibility, is less fatiguing, and insures that they will not be burdened with unnecessary equipment in case of contact with the enemy. When this is done, these items are loaded by troops detailed for the purpose in advance.

d. Individual arms should remain with the individual soldier. However, troop commanders must instruct their troops in the proper manner of boarding with arms in order to eliminate the possibility of accidents. Each man in turn passes his weapon to the man behind him, securing it again after he boards the vehicle. The last

man passes his weapon to one already aboard, securing it after boarding.

49. Detrucking Procedures

a. Normal detrucking should provide for the reassembly of units, prompt unloading of troops and equipment, clearing of unloading areas, staging, and reuniting of troops and their equipment. Except in emergency, the order to detruck should not be given by the commander until drivers have lowered tailgates to decrease the possibility of injuries.

- (1) When the area is suitable, the column may be halted in close formation and all troops detrucked simultaneously. This method is quick but may require troops in the rear to march the length of the column in assembling or in reaching their immediate destination.
- (2) A second method is to have successive trucks, truck squads truck sections, or platoons pull up to a designated point at which the troops detruck and assemble.
- (3) When troops are going into billet or bivouac, a satisfactory method is to designate a dispersal point from which guides conduct sections of the truck column to the vicinity of the billet or bivouac where the troops detruck with their equipment.

b. Emergency detrucking should be included in the training of troops since the speed with which troops can leave their vehicles and be prepared for action may be a deciding factor in the event of enemy attack. Emergency detrucking, which requires jumping over the sides of the vehicles or dismounting in any other way that may prove to be equally quick, may cause sprained or broken ankles or other injuries. Men trained in the proper techniques of emergency detrucking, however, can dismount with weapons in hand ready for use in a fraction of a minute with little danger of injury.

c. In both normal and emergency detrucking, troops should not be permitted to dismount until vehicles have come to a full stop—and then only upon the command or signal of the commander or his authorized representative (FM 55-31).

50. Distinctive Characteristics

a. Since most supply convoys operate in the communications zone or in rear areas of the combat zone, they normally require no advance, rear, or flank guards. Supply movements are made in general by truck companies with personnel sufficient only for the actual conduct of the convoy. There are no personnel available to provide security or extensive reconnaissance. When supply convoys do require reconnaissance and security, these functions are performed by troops provided for the purpose. Passive security measures, including use of cover and concealment and camouflage discipline, are used as appropriate.

b. Supply convoys should be of a size and formation which assures most effective traffic flow over the routes involved. Experience indicates that, in the operation of supply convoys, the best results are obtained with small groups of vehicles. March units of a supply movement, therefore, normally should not exceed one truck platoon and serials should not exceed one truck company.

c. Although small serials require more staff planning and involve more work in recording the progress of the movement, their use is recommended over large serials since more detailed information is possible as to their progress. Moreover, closer supervision may be exercised and changes in orders dictated by the situation may be more easily effected.

51. Composition of Supply Serials

In order to maintain maximum flexibility in the highway transport system, it is advisable to limit each serial to supplies of a generally similar nature. If it then becomes necessary to divert a certain type of supplies, the diversion order may be issued to a particular serial. It is not practicable to make rigid specifications as to how the type of supplies should determine the division between serials. In general, however, vehicles transporting gasoline, ammunition, rations, or other different types of supplies should constitute different serials so that diversions can be made according to the class of supply being transported. However, when other factors warrant the loss in flexibility, a serial may be formed of several types of supplies

needed by a certain unit or installation. Under favorable conditions and with good highway regulation, serials transporting various types of supplies may be intercepted at a highway regulation point, reorganized, rerouted, and rescheduled to meet the requirements of a specific unit or installation; although the extra work, delay, and increased possibility of error indicate the advisability of avoiding such situations.

52. Command

a. Under normal conditions, convoys hauling supplies are commanded by the senior officer or noncommissioned officer of the unit whose trucks make up the convoy. Supply movements made in vehicles of assigned or attached truck units are under the command of the senior officer of the truck unit, who, in turn, is under the command of the commander of the organization to which the truck unit is assigned or attached.

b. When the tactical situation requires an armed escort to protect a supply convoy, the senior line officer will usually be placed in command of the convoy, the highway transport officer acting as his technical adviser and subordinate commander of operating personnel. The tactical commander, as far as possible, conforms to established routes and schedules.

53. Supply Operations

Military motor transportation may be employed in various ways to accomplish specific transportation missions. These operations may be classified either by the task assigned or the type of haul. Tasks include clearing a congested area, connecting other modes of transportation, adjusting the distribution of supplies within a depot, or supporting troops in combat, or by the type of haul. Hauls may be described as local or short hauls and line or long hauls. Local or short hauls are characterized by short running time in relation to loading and unloading time. They normally involve a number of trips per day and are evaluated on the basis of tons moved during the operational period. Line or long hauls are characterized by high running time in relation to loading and unloading time. They normally involve one trip or a portion of a trip per day and are evaluated on the basis of the time con-

sumed, distance traveled, and tonnage hauled during the operational period.

54. Classes of Operation

The types of logistical support in which motor transport is employed over varying distances may include the following:

a. Port and Beach Clearance. A water terminal is a transfer point at which personnel and cargo are either transferred from water transportation to land or air transportation or from land or air transportation to water transportation. Water terminals used by oversea commands may be of the major commercial port type or, in the event that terminal capacity has been reduced, small ports and beaches. The important factor in this kind of operation is the movement of cargo away from the loading point. Port clearance, as it pertains to highway operations, is the clearing of cargo from the immediate vicinity of the port to permit continuous unloading of ships that would otherwise be hampered by backlogs of supplies within the port area. Beach clearance is the clearing of cargo from the immediate vicinity of the beach promptly, regardless of poor roads and temporary facilities.

b. Installation Support Operations. Installation support is established to provide highway transportation for commands, installations, depots, and dumps that cannot be provided by their organic vehicles. Highway transport operations at or between installations, depots, terminals, and supply dumps may be either local or line hauls. Primarily, these hauls are concerned with the adjustment of supply levels or the distribution of supplies within the supply system (FM 55-31).

c. Transfer Operations. Transfer points are transportation facilities established when required for the transfer of cargo or personnel from one unit of transport or mode of transportation to another. Highway transportation, because of its mobility and flexibility, is the primary method of connecting or bridging the gap between other modes of transportation.

d. Field Support Operations. Motor transport units may be employed in direct support of tactical operations. Armies, corps, or divisions may use organic or attached motor transport as a pooled service to be allocated where and when needed to meet the current situation.

Motor transport missions in direct support include, but are not limited to, transporting supplies and equipment to combat units; moving troops to attack or counterattack positions; and providing essential mobility for headquarters, for nonmobile equipment, and for supplies under conditions of mobile warfare. Direct support motor transport units should be equipped with task vehicles having mobility comparable to the combat vehicles of the supported unit under the anticipated environmental conditions.

e. Express Operations. Highway express operations are expedited highway movements in which vehicles and convoys are scheduled according to priority of loads. A high degree of control is exercised over these movements to assure adherence to schedules, diversions and adjustments to meet the changing situation, and expeditious delivery of cargo. Express hauls may be either line or local hauls, but usually they are line hauls.

55. Methods of Operation

There are three general methods employed to accomplish the transportation mission of hauling supplies by highway. These are classified as direct, shuttle, and relay.

a. Direct Hauling. This is the simple method of a single hauling job accomplished in one trip, involving no transfer of supplies or exchange of equipment. It is normally limited to local hauls during the initial stages of an operation before transfer or exchange points have been set up and when it may be desirable to expedite forward movements. As a line haul method, it greatly taxes drivers and equipment and often results in loss of control by the unit.

b. Shuttle. The simple shuttle is accomplished by means of repeated trips made by the same vehicles between two specified points. The continued movement forward is accomplished by a repetition of this operation by vehicles operating successive legs of the overall distance.

c. Relay. This is the continuous movement of supplies or troops over successive segments of a route without transfer of load. It is accomplished by change of drivers, powered vehicles (towing units), or both for each segment. In tractor-semitrailer operations, relay implies the through movement of semitrailers by shuttle tractors operating over segments of the route.

56. Combined Operations

Motor transport may be combined with other modes—rail, water, and, under certain conditions, air, to reduce the handling of cargo and, thus, the time en route from origin to destination.

a. Piggyback. This is the term given to the combination of rail and motor transport. Semitrailers are loaded and sealed at the point of origin, placed on rail cars, and moved forward as far as possible. At this point they are off-loaded, coupled to suitable towing vehicles, and delivered to their destinations over the highway.

b. Roll-on/Roll-off. This is the term given to the combination of water and motor transport. Loaded semitrailers are towed aboard specially constructed vessels at the port of embarkation, and transported to an overseas port. There they are coupled to towing vehicles while still aboard and moved by highway to their destinations.

57. Loads and Loading

Correct loading of cargo is essential to securing reasonable vehicle life and full use of vehicles. Full use of vehicle carrying capacity is essential to efficient and successful supply movements.

a. In loading for supply movement the following must be taken into consideration:

- (1) *Underloading.* If vehicles are loaded with less than their capacities for the existing conditions, more vehicles will be required for the task. This requires more drivers for the operation, increased highway space, and more work for highway regulation and traffic control personnel. The efficiency of all highway movement in the area is decreased.
- (2) *Overloading.* If vehicles are loaded with more than their capacities for the existing conditions, the mobility of the convoy may be seriously reduced, thus disrupting highway movement schedules and jeopardizing supported tactical operations. In addition, overloading may result in damage to vehicles, thus causing excessive vehicle deadlining which may reduce the effective capacity of the unit for a long period.
- (3) *Improper load distribution.* If vehicles are loaded with uneven or top-

heavy distribution of weight, an undue strain is placed upon some parts of the vehicle, causing excessive and uneven wear or breakage. Loads may shift or fall off, resulting in loss or damage to cargo, or unbalance may cause great difficulty in operation which can result in serious accidents.

b. Military cargo vehicles of the tactical type have been developed to give satisfactory performance when operating under off-road conditions and are powered to negotiate unusually steep grades. Thus, given a smooth hard-surfaced highway, a tactical-type vehicle can be expected to carry more than its off-road rated capacity.

c. On good roads tactical general-purpose cargo trucks and cargo trailers are permitted to carry loads over their rated capacity but not in excess of the highway load limit indicated on the vehicle data or in the technical manual applicable to the vehicle. However, only in case of emergency and upon proper authority will vehicles operating cross-country, or on anything less than smooth hardsurfaced highways, be loaded above their rated capacities.

d. Carrying more than the rated load has, by common usage, come to be called overloading; it is not in fact an overload, but a calculated safe load under favorable conditions. Responsible individuals must realize, however, that much of the safety factor built into a vehicle disappears under overloading; therefore, drivers must be instructed to exercise caution when their vehicles are loaded to maximum highway capacity.

e. In recognition of the fact that the availability of vehicles is normally less than the need and that use of the maximum calculated safe load will be general where good highway conditions exist, the driver must realize that—

- (1) Shocks to the frame and running gear of the vehicle increase as the load increases. A hole in the road that would cause no damage to springs or shock absorbers with a load of $2\frac{1}{2}$ tons may cause broken springs or ruined shock absorbers with a load of 5 tons. The best highway surface will develop some chuckholes under heavy traffic. The driver must be alert and either avoid rough spots or reduce his speed.

- (2) Heavier loads require more gear shifting. The driver must be careful in picking up the load with the clutch. Proper gear ratios must be selected in climbing and descending hills.
- (3) Highway movement often requires running at high, sustained speeds. The lubricant in the gear boxes must be checked more often and vents must be kept open.
- (4) It is *not* necessary to carry higher tire pressure since the tires normally carry the maximum desirable pres-

sure. However, it is more important to keep tires up to regulation pressure since the heavier loads will flex low tires and cause them to wear or rupture.

- (5) A heavily loaded vehicle requires more time and distance to stop than a vehicle carrying its normal load. The driver must be constantly mindful of this in maintaining his proper interval and especially when operating on surfaces affording low traction (FM 55-6, FM 55-31, and TM 21-305).

Section IV. TACTICAL MOTOR MOVEMENTS

58. Characteristics

Tactical motor movements are characterized by flexibility of employment, ability to deliver large numbers of troops over long distances in short periods of time, increased logistical requirements, and vulnerability to enemy action. Tactical movements are conducted in anticipation of contact with the enemy. Troops must be prepared for combat whether the movement is to contact, is away from the enemy, or is of any other type in accordance with operational plans. The degree of combat readiness varies with the probability of contact with the enemy. Basic characteristics of tactical motor movements include formations affording the commander ease of control, maximum flexibility for deployment upon contact, and adequate provision for reconnaissance and security.

59. Formation for Tactical Movements

In a tactical march, the formation is governed by the mission, the terrain, and the tactical situation. Units are arranged in the expected order of use or in the order in which they are to enter a new assembly area or attack position. Provision is made for immediate, conclusive action when enemy resistance is slight, and for rapid development in cases of deliberate resistance.

a. Contact Remote. When contact with enemy forces is remote, march dispositions which expedite movement are adopted. Columns having different rates of movement are assigned separate routes or are started at different times. Route column organization depends upon the

mode of transport, the road and traffic conditions, and the effectiveness of enemy long-range weapons and aircraft. Route columns employing motor transport are made up of three internal elements: the head, the main body, and the trail.

b. Contact Imminent. As the approach to contact with the enemy becomes more probable, the formation of the command will be changed from that of route column to tactical column. In tactical column, with elements of the command grouped in the manner best suited for their tactical employment and with ground security elements active, the rate of advance is somewhat slowed. The speed of advance at this state is dependent upon the inherent, tactical mobility of the troops involved, upon the size of the unit, and upon the rapidity of development of the tactical situation.

60. Reconnaissance and Security

Reconnaissance and security are vital to any tactical movement of troops. In any tactical situation, timely and accurate information of the enemy and the terrain is of primary interest to the commander in making his decisions as to movement and formation of his command. Security elements assure the continued advance of the command, protect it from surprise ground attack, deny observation by the enemy, and give timely warning in the case of air attack. Security elements and measures include the following:

a. Covering Force. A force normally operating well forward of the main force with the

mission of early development of the situation; crushing enemy resistance when possible, and deceiving, delaying, and disorganizing enemy forces until the main force can prepare for action. The covering force precedes the advance guard of the column and provides its own security.

b. Advance Guard. The advance guard has the mission to prevent delay of the main body and to protect it against surprise attack. Its size, composition, and disposition vary with the mission, terrain, and tactical situation.

c. Flank Guards. Flank guards cover routes of approach that might be used by hostile forces to attack the flanks of the column, driving off harassing forces and giving timely warning of the approach of larger enemy forces.

d. Rear Guard. The rear guard follows and protects the main body on the march, defeating or delaying hostile forces attacking from the rear, protecting the trains, and collecting stragglers.

e. Air Guards. Air Guards are placed on all vehicles to warn of the approach of enemy aircraft. In addition to the security afforded by air guards, defense against air attack is achieved by the continuous manning of antiaircraft guns, dispersion, and the maintenance of proper distances.

f. Communication Security. Communication security, normally prescribed in standing signal instructions (SSI), insures adequate protection against enemy communication intelligence activities such as radio interception, position finding, traffic analysis, and cryptanalysis.

g. Organic Army Aviation. Organic Army

aviation is used to the fullest extent on close and distant reconnaissance, selection of alternate routes, movement of security forces, and highway regulation and control.

61. Command

Since tactical movements are, in general, movements to contact and since the success of the operation may be dependent upon the rapid and efficient tactical deployment of troops, the commander of combat troops commands the tactical movement regardless of whether it is made in organic vehicles or in temporarily attached or assigned vehicles. If a transportation unit is supporting the operation, the commander of this unit acts as a subordinate commander and technical transportation adviser to the tactical commander.

62. Loading

Loading for a tactical motor movement, normally is done in the manner best suited to the speedy employment of troops according to their normal methods of combat. Full use of transport space is subordinated to tactical considerations. Techniques and procedures of entrucking and detrucking used in administrative movements; however, may be modified to fit the tactical situation. Adequate security must be provided since troops are particularly vulnerable in entrucking and detrucking areas. This security must include the maximum use of cover and concealment, dispersion in conformity with tactical considerations, and the highest standards of troop discipline to meet the requirements for defense against atomic weapons.

CHAPTER 5

MOTOR MOVEMENTS IN THE UNITED STATES

Section I. GENERAL

63. Types of Motor Movement

Motor movements in the United States may be generally classified in three categories: the casual movement of military vehicles performing maintenance, housekeeping, and administrative duties incidental to the operation of continental installations; the movement of convoys engaged in supply activities or the transfer of personnel; and training movements under conditions simulating those that might be encountered in a theater of operations.

64. Considerations

Basically, all military motor movements in the United States are made with consideration for and in coordination with normal civilian traffic over routes under civilian control. In ef-

fecting this coordination with civilian authorities, those responsible for military movements must consider the mission of the specific operation and should make every effort to insure that final decisions on coordinated traffic control will effectively accomplish that mission. This is particularly important when conducting tactical training movements since the effectiveness of the training is directly proportionate to the simulation of combat conditions. However, regardless of the purpose of military movements in the United States, it is the responsibility of all concerned to insure meticulous compliance with all applicable state and local laws, ordinances, and regulations to promote the safe and efficient movement of both civilian and military traffic.

Section II. COORDINATION WITH CIVILIAN AUTHORITY

65. Clearances

a. To insure compliance with state and local laws, safeguard highway facilities, and to avoid delays and accidents, movements within the continental United States, its territories, and possessions are coordinated with state or local highway traffic authorities concerned and other appropriate civilian agencies. For example, the movement of 10 or more vehicles organized to operate as a column, the dispatching of 10 or more vehicles per hour to the same destination over the same route, or the movement of military vehicles of sizes or weights unusual for ordinary highway travel should be cleared with civil authorities. All necessary permits, clearances, escorts, and guides prescribed by civil authorities should be secured as far in ad-

vance as practicable and in no case, except in an emergency, less than 24 hours in advance of the movement (AR 55-162).

b. In intrastate movements by highway, civilian assistance in planning is obtained by the local installation or unit transportation officer, who makes the necessary arrangements with the highway traffic authorities of the state concerned and other appropriate civilian agencies.

c. In interstate movements within one army area, the matter should be referred to the area transportation officer, who coordinates the movement with the authorities of the various states concerned.

d. When the movement will pass out of the army area in which it originates, the transportation officer of that area coordinates the move-

ment with the transportation officers of all areas through which it passes, and the transportation officer of each such area coordinates the movement with the proper civilian authorities within his area.

e. Civilian authorities are furnished with any information (except classified data) which they request. The information which may be given to civilian authorities is governed by regulations and directives existing at the time of the movement. For example, during peacetime the identity of troops being moved is normally not concealed, but in case of war or imminent war, this information is usually secret.

f. The following illustrates information which civilian authorities may desire:

- (1) Origin and destination of movement.
- (2) Desire to enter state at _____ (hour) on _____ (highway number or name) at _____ (point).
- (3) Desire to leave state at _____ (hour) on _____ (highway number or name) at _____ (point).
- (4) Designation of column.
- (5) Officer in command.
- (6) Number of vehicles.
- (7) Personnel strength.
- (8) Necessary halts.
- (9) Column does (does not) have explosives. If so, their nature.
- (10) March characteristics of column (speed, type of column, distances between vehicles). If military terms are used such as "open column," "close column," "infiltration," or "SM," an explanation should be given.
- (11) List of overweight or oversize vehicles with characteristics of each.
- (12) Other data pertinent to the move such as blackout or other unusual operations.

g. Civilian authorities may, in return, be of material assistance to military authorities by furnishing advice as to —

- (1) Most practicable route(s) to be used and identifying route markings.
- (2) Alternate route(s) and identifying route markings.
- (3) Points where it may be advisable to divide columns and use two or more

routes to alleviate congestion or road wear.

- (4) Time when it is best to pass through areas of traffic congestion or traffic defiles.
- (5) Vehicle spacing and speeds most desirable for coordination with other traffic.
- (6) Location and nature of any unusual road conditions.
- (7) Highway repair work which may be encountered.
- (8) Information on weight limitations of bridges and clearances in height and width along the route.
- (9) Location of service and supply facilities.
- (10) State and city police escorts to assist the column.
- (11) Availability of police communications system for emergency messages, including possibility of tuning column radios into police net.
- (12) Location of hospitals available in case of emergency.
- (13) Procurement of dependable road maps.

h. Whenever unforeseen circumstances dictate a change in plans for the movement, the civilian agency concerned should be notified promptly of the change.

i. Information in *a* through *h* above does not preclude the establishment of standing operating procedure with the proper state or local authorities for the coordination of local, routine, or regional movements in the vicinity of or between installations.

j. So far as the civilian practice permits, contact with civilian authorities should be informal and, when practicable, should be established by personal conferences between civil authorities and the appropriate commander or his representative. When time will not permit personal conference, liaison should be established by telephone, telegraph, or radio, in which event sufficient information will be furnished to permit intelligent planning.

66. Traffic Escorts

a. Normally, military police provide traffic escorts as needed; however, civil authorities may provide the escorts necessary in assisting a movement through congested areas.

b. A city, county, or state police force may furnish a traffic escort for the length of the movement within their respective jurisdictions, but arrangements should be made for another traffic escort, when needed, to meet the column at the point where it leaves one area and enters another.

c. Civilian police escorts may be provided to aid the military police. When military police are not available, civil police may furnish the entire escort.

- (1) In the absence of both civilian and military police, such traffic escorts as may be needed are furnished from the column.
- (2) It should be kept in mind that military police or escorts furnished by the column do not have the same authority over civilians as civilian police (except in case of martial law). In practice, military police will usually be obeyed, but soldiers other than military police, used as traffic escorts should be carefully selected and well instructed to reduce the probability of antagonizing civilians encountered in the course of their duty.

67. Tolls and Ferries

Normally, there is an arrangement between the Army and authorities controlling a toll route or ferry under which tickets are provided or slips signed to cover the passage of army vehicles. Commanding officers of columns should ascertain in advance whether there are any toll bridges, tunnels, or ferries on their routes, and should be sure that they are prepared to comply with the prescribed procedure.

68. Reconnaissance

Main roads within the United States are generally good, lacking in prohibitive grades, and of high capability. They are well signed and marked; good, up-to-date road maps are readily available; and civil authorities can furnish information concerning roads under repair, unusual conditions, bridge capacities, detours, and

other restrictions. However, reconnaissance in some form should be conducted prior to any motor movement.

69. Safety Precautions

Civilian safety precautions for movements in the United States are fully applicable to military movements. So far as is consistent with military necessity, it is the policy of the Army to conform to all interstate commerce and local safety regulations.

70. Quartering Parties

In cases involving the movement of personnel within the United States, it is necessary to make arrangements in advance for bivouac areas, quarters or billets, loading and parking facilities, supplies and rations, water, fuel, and medical assistance so that all are provided prior to the arrival of the column. This often involves selection of suitable areas and rental of facilities under varying conditions and requires careful selection of personnel to perform these duties adequately.

71. Followup Parties

The functions of a nontactical followup party are especially applicable to movements in the United States, where it is important that property used for bivouacs or quarters should be left in the same, or better, condition than before occupancy by troops. The followup detachment is designated to inspect bivouac areas and other halt sites after they have been vacated by the column and to correct and report any deficiencies observed. The followup party also completes necessary paperwork in connection with leased camp sites or with claims arising from damage to private or public property. On the road this party may also pick up guides, guards, and markers which have been placed by the advance party, make final investigation of accidents when military police are not available, and dispose of disabled vehicles separated from the column. The public relations aspect of the followup party's duties is of great importance to the unit concerned and to the army in general.

Section III. MOTOR MARCHES AND CONVOYS

72. Motor Movements for Training

Training movements are normally made in formations suitable to the simulated tactical

conditions of the exercise. To accomplish the training mission with due consideration to normal civilian traffic on the assigned routes, a high

degree of coordination must be maintained between the commander and his staff and the appropriate civilian authorities. In the interest of good public relations, ample notice should be given through newspapers and other media to the general public along the selected routes as to the purpose, the routes, and the schedules of the proposed exercise. So far as practicable, the movement should be scheduled for periods of light civilian traffic and congested areas should be avoided. Adequate route reconnaissance is obligatory; traffic escorts should be provided where necessary; and discipline must be rigidly enforced on the march, at halts, and in bivouac.

73. Movement of Convoys

Except in the event of war or the threat of war, the movement of convoys engaged in supply activities or the transfer of personnel within the United States normally will be limited to preparation for maneuvers or relief operations

in cases of local or regional calamities. In the former case, coordination with civilian authorities is initiated early in the planning phase and maintained throughout the operation. Formations for such convoys are dictated by the factors of civilian traffic, military traffic control, and expediency. Prior to the movement of convoys, all commercial means of transportation must be investigated and evaluated in terms of economy to the Government and the efficient accomplishment of the assigned mission. In cases of relief to stricken areas, supply and personnel convoys usually are given a high priority over routes offering the most expeditious access to the area. Civilian authorities will reroute or delay civilian traffic that is not also engaged specifically in relief activities, and the commanders of military convoys will thus be operating under conditions normally found only in a theater of operations.

PART THREE

PLANNING MOTOR MOVEMENTS

CHAPTER 6

PRINCIPLES OF MOVEMENT PLANNING

Section I. COMMAND AND STAFF DUTIES AND RESPONSIBILITIES

74. General

a. Every motor march and convoy should be organized along a previously prepared plan. In some cases, such a plan may merely tell where to go, what vehicles to take, the route to take, and when to start. Such simple plans may require only a moment's thought and an oral order. In other cases, extensive study and detailed written orders from different echelons of command are necessary to insure an efficient movement. In every case the planning should be limited to that required for the efficient accomplishment of the mission. Both overplanning and oversimplification should be avoided.

b. When highway movements are regulated, the coordination and most of the planning are performed by the appropriate staff. In such cases, planning by convoy and march unit commanders is normally restricted to that necessary to assure that the unit complies with orders issued and that it marches in an orderly, systematic manner under the instructions received.

c. If a unit is given an order to move and a plan has not been furnished by higher command, details to implement the move must be worked out by the unit command. When a possibility of a serious traffic conflict exists, the commander conducting a march will request

highway clearance prior to beginning the movement.

75. Unit Commander

Regardless of the size of the unit, the commander alone bears the full responsibility for the planning and execution of motor movements of his unit in the same manner as for any other operation. His staff assists as he directs by securing necessary information, by preparing estimates and recommendations, by preparing detailed plans and orders based on his decisions, and by issuing orders and supervising their execution. The commander uses his staff to the degree demanded by the situation, the complexity of the operation, and the time available for staff action. The timely issuance of warning orders serves to alert troops and prepare them for a move before receipt of the detailed operation order for the move. The operation order for a road move covers all essential details, usually in the form of a five-paragraph operation order, and may include as annexes a road movement table and an administrative annex. (An example of an operation order for a road movement follows this paragraph.) Commanders of subordinate units should receive the operation order in sufficient time to prepare plans and issue orders as necessary for the efficient participation by their units in the movement.

EXAMPLE OPERATION ORDER FOR A ROAD MOVE

(intended as a guide only)

(SECURITY CLASSIFICATION)

Copy No. 4
21st Inf Div
YREVA (YZ351512), BLOKSKY
011030 October 19—
YZ 63

OPORD 14

Reference: Map, BLOKSKY, 1/250,000, NOTKLOTS-DRAKCIR
Time Zone A.

Task Orgn: Annex A, Task Organization

1. SITUATION

- a. Enemy forces:
 - (1) Annex B, Intelligence
 - (2) Indications are that Aggressor will continue to delay the advance of V Corps.
- b. Friendly forces: V Corps attacks 030400 Oct to seize PIESDA.
- c. Attachments and detachments: Annex A, Task Organization.

2. MISSION

21st Inf Div moves commencing at 012030 Oct from YREVA (3551) to NAEJ (4053) as V corps reserve.

3. EXECUTION

- a. Concept of operation: Div moves on four routes from army reserve to V Corps reserve. Annex C, Road Movement Table. Annex D, Route Overlay.
- b. 1st Bde:
- c. 2d Bde:
- d. 3d Bde:
- e. 1/22 Cav: Move at 011800 Oct to secure div assembly area vic NAEJ.
- f. Div Arty:
- g. Div Trps:
- h. Spt Comd:
- i. Coordinating instructions: Upon closure in new assembly area, units coordinate security with 1/22 Cav.

4. ADMINISTRATION AND LOGISTICS

ADMINO 19

5. COMMAND AND SIGNAL

- a. Signal:
 - (1) SOI, Index 1-15.
 - (2) Continue radio listening silence.
- b. Command: Div CP moves at head of Div Trps.

Acknowledge

ABLE
Maj Gen

Annexes: A—Task Organization
 B—Intelligence
 C—Road Movement Table
 D—Route Overlay

Distribution: A

OFFICIAL:

/s/ Lumpkin
 LUMPKIN
 G3

(CLASSIFICATION)

NOTE: Annexes are not included in this example.

76. Staff Duties in Movement Planning

a. The duties of staff sections vary substantially with the type and size of the movement. General staff duties outlined below may be modified to fit specific unit requirements.

- (1) G1 plans and coordinates the movement of the headquarters, and submits requirements to G4 for the transportation of replacements, prisoners of war, and repatriates.
- (2) G2 supervises procurement and issue of necessary maps and photographs; keeps the commander and staff informed on the enemy situation and capabilities, weather, and terrain; directs counterintelligence activities associated with movement; and initiates and directs the collection of additional information as required.
- (3) G3 plans, coordinates, and supervises the tactical and training aspects of all troop movements, selecting and designating destinations, priorities, and times, organization for movement and march formations, and routes where the selection has tactical implications. G3 also provides security for the movement, authenticates and issues movement orders, and coordinates activities in road movement with G4.
- (4) G4 plans, coordinates, and supervises the logistical aspects of all troop movements. His staff duties include administrative transportation of units, personnel, and supplies; provi-

sion of transportation and logistical support to tactical movements; control of movements to include the selection of routes (in coordination with G3 when the selection has tactical implications), highway regulation, and traffic control; preparation of orders, annexes, or instructions pertaining to regulation or control measures; selection and designation of service units; establishment of priorities for service units; and selection and designation of destinations and times for the movement of service units. G4 also exercises general staff supervision over the highway traffic headquarters.

- (5) G5 determines requirements for the transportation and movement of civilian supplies and coordinates with G4. G5 also determines the capabilities and availability of civilian transportation and so informs G4.

b. Special staff functions in the planning of motor movements include the following:

- (1) *Transportation officer.* The transportation officer makes plans and recommendations pertaining to requirements for, availability or and employment of transportation and transportation troops within the command. He plans and supervises preparation of detailed plans for movement of troops and supplies. He directs the preparation of plans and orders pertaining to the regulation of transportation means, to include

the enforcement of established priorities as to the use of transportation. He coordinates all organic, attached, and supporting transportation agencies of the command, to include civilian transportation when appropriate. He directs the preparation and maintenance of records, studies, graphs, and plans pertaining to the employment of transportation of the command to include such items as availability tables, assignment tables, road distance and time length tables, road movement graphs, loading plans and the highway regulation plan. He exercises staff supervision over the traffic headquarters. In the performance of the above duties, the transportation officer is responsible to the commander, under the general staff supervision of G4.

- (2) *Provost marshal.* The provost marshal exercises staff supervision for traffic control. He normally maintains close liaison with the transportation officer, G3, and G4 and, based upon the movement plans of the unit, coordinates traffic control reconnaissance and prepares the road traffic control plans. The provost marshal recommends traffic control policies and plans the use of military police units for enforcement of approved traffic control policies. He is also responsible for providing timely information to military police units and operating personnel and for liaison with other agencies and concerned with traffic regulation and control. In addition, he maintains representation in the traffic headquarters.
- (3) *Engineer.* The engineer plans and supervises the engineer operations

pertaining to the storage, reproduction, and distribution of maps and map substitutes under general staff supervision of G2 (in ROAD divisions, procurement, and distribution of maps is a function of the supply and transportation battalion); engineer reconnaissance, field surveys, mapping projects, and the preparation of terrain studies; recommendations for traffic regulations on roads and bridges as indicated by their physical condition; preparation and posting of signs for route marking and traffic control on permanent routes; issue of signs and/or sign materials to military police units for preparation and posting of temporary signs on routes; and the construction, maintenance, and repair of roads and trails. In the performance of these duties, the engineer coordinates with and maintains liaison with appropriate staff sections.

- (4) *Aviation officer.* The aviation officer submits recommendations to the commander pertaining to the use of organic army aviation. He coordinates with G2 and G3 during the development of plans concerning reconnaissance, movement of security forces, and control.
- (5) *Signal officer.* The signal officer advises the commander on the communications available for control of motor movements. He coordinates with G2, G3, and other staff officers during the development of plans to determine intracolumn communications, assignment of radio frequencies, procedures for communication with Army aircraft used to control the column, and the feasibility of using local police communications.

Section II. STEPS IN MOVEMENT PLANNING

77. General

Highway traffic planning is a continuing process during the course of an operation. Concurrent movements are separated in space by assignment to nonconflicting zones of movement, routes, or traffic lanes. Movements can be

separated in time by scheduling to avoid conflict. The plan must be adaptable to ready modification, expansion, or alteration.

a. Only with the cooperation of all elements using the highways may the traffic authority properly perform its functions of regulation and control (pars. 83–86).

b. Knowing the number, nature, and capabilities of the highways and the quantity and nature of that which is to be moved, the highway transport officer must plan the number and type of vehicles and truck units needed. These plans must reflect consideration of the factors of trafficability, highway adequacy, and economy. The vehicles selected should be suited to the road, weather, and terrain conditions imposed by the situation; should conserve road space by the use of maximum loading where possible; and should provide maximum use of personnel and fuel. Plans must be made for the necessary highway transport personnel, not only for the actual hauling but also for command and staff supervision, including highway regulation functions and coordination with appropriate ordnance support units.

c. The location of terminals, depots, and dumps must be planned to conform to the general traffic circulation plan. In addition, it must be practicable for vehicles to reach the dumps or depots, even in bad weather, and there must be sufficient hardstanding for operation within the installation.

78. Determination of Requirements

Estimates of requirements for motor movements are made on a continuing basis at all command and staff levels. At each echelon of command, prospective users of transportation, or their staff representatives, periodically submit an estimate of requirements for transportation for a future period including insofar as possible amounts or tonnages of personnel, equipment, and supplies to be moved, and the origin and destination of movement. The transportation officer of the command assembles these estimates, makes adjustments or corrections in accordance with changing situations, and adds any known requirements imposed by higher authority.

79. Movement Capabilities

Current knowledge of transportation capabilities is essential to movement planning. This knowledge is maintained by the compilation of information on the physical characteristics of the various types of transportation available to the command, highway transport units assigned or attached, and truck-lift capabilities of organic and other available transportation. Also in-

cluded in this analysis is information on the capability of units and installations to receive and ship.

80. Establishment of Priorities

Requirements sometimes exceed capabilities, thus imposing a need for the establishment of priorities in order that the commander's plan may be appropriately implemented. Priorities are established by coordination between G4 and G3. Actual implementation of the established priorities is a responsibility of the transportation officer (par. 76).

81. Initiation of Highway Regulation Plan

Planning the regulation of highway transportation over routes is a responsibility of the staff transportation officer. The planning for highway regulation starts well in advance of actual operations and is a continuing process fully coordinated between all interested echelons of command to insure complete integration in the overall plan.

a. *Traffic Reconnaissance.* An accurate, current, and comprehensive knowledge of the highway network, transportation facilities, and conditions is essential as a basis for the traffic circulation plan. Information gained from traffic reconnaissance agencies should include the characteristics of the road net; a survey of possible locations for dumps, terminals, and other facilities; and such traffic information as existing or anticipated traffic density and traffic volume, location of areas of probable traffic congestion, and needs for traffic control.

b. *Estimate of the Situation.* An estimate of the situation is prepared by the staff transportation officer concurrently with and based, in part, upon the information gained from the reconnaissance. This estimate will reflect transportation intelligence; current tactical plans; quantity, type of traffic, origin, destination, and date; policies, priorities, and restrictions imposed by higher headquarters; location of installations; and the road net and traffic flow. In preparing this estimate, planning and intelligence activities at all echelons of command will be considered. Early coordination of these activities insures the inclusion of essential information.

c. *The Highway Regulation Plan.* The highway regulation plan is based upon the estimate of the situation and the decision of the commander concerned. Details of the plan will depend upon the level of the command and the regulation and control necessary. Most highway regulation plans, however, will contain the following information:

- (1) Traffic circulation plan, including road net and direction of movement, classification of routes, bridge capacities, tunnels, and other restrictions on the route.
- (2) Priorities of movement for vehicles and convoys.
- (3) Location of depots, ports, and terminals.
- (4) Communication system.
- (5) Speed, safety, use of lights, security, and other pertinent regulations.
- (6) Location of highway regulation points, military police traffic control points, and ordnance road patrols.
- (7) Reporting procedures.
- (8) Makeup of march serials and convoys.
- (9) Methods of scheduling and reporting the progress of convoys and other movements.
- (10) Regulations concerning convoy clearances; arrangements with civil authorities (when applicable).

- (11) Procedures for highway movements such as those through area commands and into the combat zone (army service area).
- (12) Location of support facilities (petroleum, mess, medical, and ordnance).

82. Routing and Scheduling

Routing and scheduling are done on the basis of all planning and information outlined above. Routing is the planning of movements over designated routes. It may be accomplished through balance (vehicle performance characteristics balanced against road characteristics and limitations), separation (separating concurrent movements by placing them on non-conflicting routes), and distribution (spreading the demand for road space and traffic over as many of the available roadways as possible). Scheduling is the time apportionment of road ways used for road movements. The proper coordination of time and space factors through routing and scheduling should insure maximum use of the highway net with minimum congestion. Provision also must be made for emergency routing and scheduling to make adjustments necessitated by changes in the tactical situation, and both column commanders and military police should be informed in advance of the prescribed procedures.

CHAPTER 7

TECHNIQUES OF MOVEMENT PLANNING

Section I. HIGHWAY REGULATION AND HIGHWAY TRAFFIC CONTROL

83. General

The planning requirements for highway regulation and traffic control will vary with the size of the command concerned, the highway net, the logistical situation, and the mission, composition, and disposition of tactical units. Since the plans of higher headquarters have a constant bearing upon operation of smaller elements, a knowledge of the basic planning factors and techniques employed by the higher staffs is helpful to those having planning responsibilities at any echelon. Military highway regulation and traffic control include the coordination and control of all movements over highways, streets, roadways, and within traffic terminals for the purpose of meeting military needs with a minimum of congestion or conflict and with maximum flexibility. This coordination is usually exercised through the highway traffic headquarters.

84. Consideration of Planning Factors

The planning for highway regulation and traffic control involves basic staff functions such as examination of the assigned mission; collection, collation, and evaluation of information; estimate of the situation; and preparation of recommendations.

a. Highway regulation planning is a function of the transportation officer and specifically involves—

- (1) The assigned mission, which may be an extension of the tactical mission of the command, specifying critical points and critical time factors.
- (2) Traffic reconnaissance, which will include collection of information on the

physical capabilities and limitations of routes and facilities; traffic densities and flow; signal communications; traffic control measures; and an analysis of such information with recommendations as necessary.

- (3) An estimate of the situation which will reflect current transportation intelligence; operational plans of the command; quantity, type of traffic, origin, destination, and date of movement; policies, priorities, and restrictions imposed by higher headquarters; location of installations; and the road net and traffic flow.
- (4) Preparation of the highway regulation plan, based upon the decision of the commander and upon the above-mentioned preliminary data. This plan is included as an annex to the administrative order.

b. Highway traffic control planning is a function of the provost marshal who coordinates with staff personnel responsible for highway regulation planning. Performance of this function involves—

- (1) Traffic control reconnaissance to secure information pertinent to the planning of traffic control.
- (2) Analysis and coordination of information collected.
- (3) Preparation of an estimate of the situation reflecting current traffic intelligence, enemy situation, operational plans of the command, and orders and restrictions imposed by higher headquarters.
- (4) Preparation of a traffic control plan

to enforce the provisions of the highway regulation plan. Continuous liaison with appropriate staff sections must be maintained to insure close coordination in planning.

85. Road Reconnaissance

Road reconnaissance should be as thorough as the situation and the time available will permit. Ground reconnaissance normally is preceded by a study of available maps and air photographs of the area, a review of intelligence reports and transportation intelligence studies, and conferences with personnel familiar with the area. Road reconnaissance parties usually include engineer personnel and also may include military police and transportation personnel. Light aircraft, both rotary and fixed wing, may be used to advantage in road reconnaissance—supplementing, or substituting for, ground reconnaissance and transporting ground reconnaissance parties to critical points. Reconnaissance parties are assigned specific missions for the collection of information. Engineer members of such parties confirm the condition of the route. They also determine dimensions and other data unless this information is available from other sources.

86. Traffic Control Planning

Traffic control planning for most highway

movement is confined to the selection of control methods suitable to conditions, the designation of personnel to perform the function, and the selection of critical areas requiring maximum control measures. During the course of traffic control planning, the selection of methods of control to satisfy requirements is based upon the principle of minimum personnel requirements. Traffic control methods include the following:

a. Point Control. Personnel operating traffic control posts (TCP's) control traffic, enforce laws and regulations, give information and on-the-spot directions to drivers, and perform other military police functions.

b. Patrols. Patrols are mounted military police circulating in certain areas or moving along designated routes for the purpose of controlling traffic, enforcing traffic laws and regulations, and performing other military police functions.

c. Escorts. Escorts are mounted military policemen assigned to accompany a specific movement to expedite or facilitate its progress.

d. Signs and Devices. Regulatory, guide, and warning signs and devices are installed on roads to insure that users know the traffic regulations that apply, are given timely warning of road hazards, and are directed to their destinations (FM 19-25).

Section II. OPERATIONAL PLANNING

87. Preliminary March Data

a. The march planner, having certain basic data, may determine by simple arithmetic additional information which he may desire in regard to a movement.

b. The planner will normally know the number and types of vehicles in the column, the origin and destination of the convoy, and the time of arrival at the destination. He can determine from his map the number of kilometers or miles the convoy must travel and from his schedule the number of hours it should require. By dividing kilometers or miles by hours he can determine the rate of march vehicles must maintain to meet the schedule. If he knows something of the road conditions and the skill of his drivers he can make a reasonable estimate of safe driving distances, positions vehicles should

maintain in the column, and how the march units will be formed.

c. Road movements for small units may be planned with a minimum of preliminary data. The commander must first know the assigned task or mission, the destination, the time of completion, and the equipment required. In addition to this basic information, he determines the departure time, the road distance, the time distance, and the required rate of march. Consideration of these factors will produce an adequate road movement plan which may easily be implemented by an operation order.

d. The larger and more complex the movement, the more complete and detailed must be the planning. If the movement is scheduled over a dispatch route, exact data as to road space allocated, time space allowed, and other factors

of lead, gap, and length, in both time and space, may be required to be known. The rate of movement necessary to meet the point schedule, both within the limitations of the other factors and as limitations on them, must be determined. In consideration of the mission, the planner determines the tactical or administrative purpose of the move, special measures or arrangements necessary to insure its accomplishment, and the load to be transported in troops or cargo or both. In regard to the march formation, the planner considers the number and types of vehicles or units required, the method of dispatch or grouping for movement and relative positions in the column, and the time required for the move considering the maximum allowable speeds of the vehicles, their average running times, and the effect of the rate of march on march organization. In selecting the route to be traveled, the march planner considers loading points for elements of the convoy, the start point for the movement, critical points along the route, scheduling of halts, probable traffic and road conditions, and release points.

e. Normally, the march planner either has or is supplied with the information mentioned above. March formulas are the means by which he applies the known data to secure other information. However, march formulas are only one aid to the march planner in evaluating his mission and in gathering information which the commander may desire in regard to the movement. They should be used in conjunction

with other planning aids such as road movement graphs and road movement tables.

88. Time and Distance Factors in Movement

The relationship between distance and time is the basis for all march planning (fig. 1). The corresponding factors as used in movement planning are as follows:

a. Those pertaining generally to columns or to elements within columns.

Length Time length

Gap (distance) . Time gap (time interval)

Lead Time lead (headway)

b. Those pertaining generally to the column on the route.

Road space . . . Time space

Road distance . . Time distance

Road clearance . . Road clearance time distance.

89. Distance Factors

The distance factors of a march may be expressed in miles, yards, and feet or in kilometers and meters. The metric system is used when military or foreign maps are used. In the United States, however, nonmilitary maps show distances in miles. These factors are defined below.

a. The length of any column or element of a column is the length of roadway it occupies, measured from front to rear.

b. Road space is the total length of roadway

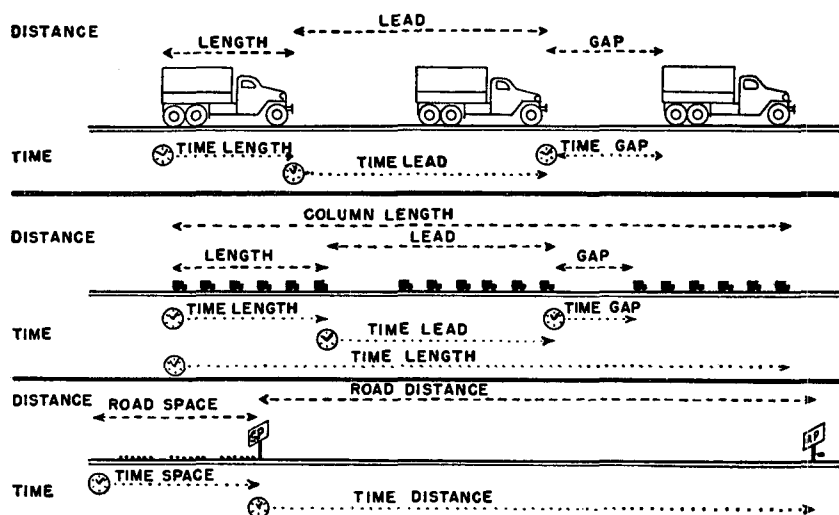


Figure 1. Space and time factors.

occupied by a column or element thereof plus any space in addition to the length which may be required as a safety factor or to maintain flexibility. For example, a column of three serials, each one kilometer in length, with 500-meter gaps between serials, and a 1-kilometer gap to the next column would have a *length* of 4 kilometers and a road space of 5 kilometers.

c. Gap is a term used to designate distance between successive vehicles or elements in a column or between successive columns as measured from the rear of one element to the front of the following element.

d. Lead is the linear spacing between the heads of elements in a column or between successive heads of successive vehicles, serials, march unit, or columns.

e. Road distance is the distance from point to point by road, expressed in kilometers or miles.

f. Road clearance distance is the total distance that the head of the column must travel for the entire column to clear a given section of road.

90. Time Factors

Time factors are used to clock the relative positions and passage of elements of a march and are expressed in seconds, minutes, or hours. Each of the following time factors is related to a corresponding factor of distance.

a. Time length is the time required for a column or element thereof to pass a given point.

b. Time gap is the period of time between the tail of one element or vehicle and the head of the next as they move past any given point.

c. Time lead (headway) is the period of time between the head of one element and the head

of the next. (For individual vehicles, there is little difference between time gap and time lead.)

d. Time distance is the time required to move from one point to another at a given rate of speed.

e. Time space is the time consumed while a column or element thereof proceeds past any point en route. It includes the time gaps between subordinate elements and additional time required for safety and for maintenance of flexibility.

f. Road clearance time is the total time a column or element thereof requires to travel over and clear a section of road. Road clearance time equals time distance plus the time length of the column.

91. Rate of Movement

Rate of movement is the ratio of distance to time. Although no exact distinction is made between terms expressing rate of movement, the following distinctions are helpful to march planners:

a. Speed is the actual rate at which a vehicle is moving at a given time as registered on the speedometer. It usually is expressed in kilometers or miles *per* hour. For some purposes, meters or miles *per* minute are also used.

b. Pace is the regulated speed of a column or element as set by the pace setter. It undergoes constant adjustment due to terrain and road conditions along the route of march.

c. Rate of march is the average distance traveled in any given period of time including periodic halts and other short delays. It is expressed in kilometers or miles *in the* hour. (This factor is not broken down into minutes.)

Section III. PLANNING AIDS

92. General

To facilitate planning for road movement and timely dissemination of pertinent information to the troops concerned, personnel planning the movement normally use such planning aids as march formulas, road movement graphs, and road movement tables. Checklists compiled by the personnel concerned are also helpful to insure the inclusion of all information necessary to efficient operation.

93. March Formulas

March formulas represent the basic arithmetic of march planning. By means of these simple formulas the planner may solve for the unknown factor necessary for the completion of his movement plan. There are three basic march factors: distance (D), rate (R), and time (T). When two of the three factors are known, the third may be found by simple arithmetic equation, as—

$R = \frac{D}{T}$ (rate equals distance divided by time),

$T = \frac{D}{R}$ (time equals distance divided by rate), and

$D = R \times T$ (distance equals rate multiplied by time).

Any of the distance factors—length, gap, lead, or road distance—may be substituted in the equation if the corresponding time factors are also substituted. Corresponding units of measure must be used throughout. For example:

a. *Determining Rate Factors.*

- (1) *Rate* (meters or yards per minute) equals *length* (meters or yards) divided by *time length* (minutes).
- (2) *Rate* (kilometers or miles in the hour) equals *road distance* (kilometers or miles) divided by *time distance* (hours).

b. *Determining Time Factors.*

- (1) *Time length* (minutes) equals *length* (kilometers or yards) divided by *rate* (yards per minute).
- (2) *Time lead* (minutes) equals *lead* (meters or yards) divided by *rate* (meters or yards per minute).
- (3) *Time space* (hours) equals *road space* (kilometers or miles) divided by *rate* (kilometers or miles in the hour).
- (4) *Time distance* (hours) equals *road distance* (kilometers or miles) divided by *rate* (kilometers or miles in the hour).

c. *Determining Distance Factors.*

- (1) *Gap* (meters or yards) equals *rate* (meters or yards per minute) multiplied by *time gap* (minutes).
- (2) *Lead* (meters or yards) equals *rate* (meters or yards per minute) multiplied by *time lead* (minutes).
- (3) *Distance* (miles) equals *rate* (kilometers or miles in the hour) multiplied by *time distance* (hours).

d. *Converting Factors Into Others of the Same Class.*

- (1) *Length* plus *gap* equals *lead*.
- (2) *Time length* plus *time gap* equals *time lead*.
- (3) *Distance* in miles multiplied by 1,760 equals *distance* in yards.

Distance in kilometers multiplied by 1,000 equals *distance* in meters.

Distance in kilometers multiplied by .63 (or 5/8) equals *distance* in miles (approximately).

Distance in miles multiplied by 1.4 (or 8/5) equals *distance* in kilometers (approximately).

- (4) *Time* in hours multiplied by 60 equals *time* in minutes.
- (5) *Rate* in miles per hour multiplied by 30 equals *approximate rate* in yards per minute.

94. Road Movement Graphs

A road movement graph is a time-space diagram. It is an easily used device for the visual presentation of movement so that conflicts and discrepancies may be prevented in the planning stage before congestion occurs on the route. Road movement graphs are used by staffs in planning and, when applicable, in supervising or regulating complicated movements. They are also used in preparing and checking road movement tables, and they provide a convenient means of recording actual moves of units over a period. The unit of measure used (kilometers or miles) will depend on the requirements of the authorities concerned.

95. Preparation of the Road Movement Graph

The road movement graph is based upon an analysis of the route from maps of the area and current highway information to ascertain critical points along the route such as cities, towns, road junctions, and bottlenecks, and to determine the road distances between major points. The road movement graph is prepared on cross-section paper with a vertical scale showing distance in kilometers or miles and a horizontal scale showing time. The lower left-hand corner of the sheet will thus represent the start point at the earliest time movement is contemplated. In figure 2, the lower left-hand corner represents a start point at Roland at 0400. The way in which road movement graphs are prepared is indicated in *a* and *b* below.

a. *Scheduling the head of the column.* Looking at figure 2, assume that a movement is to start at Mount Royal (25 miles on the vertical scale) at 0700. The movement will proceed to a

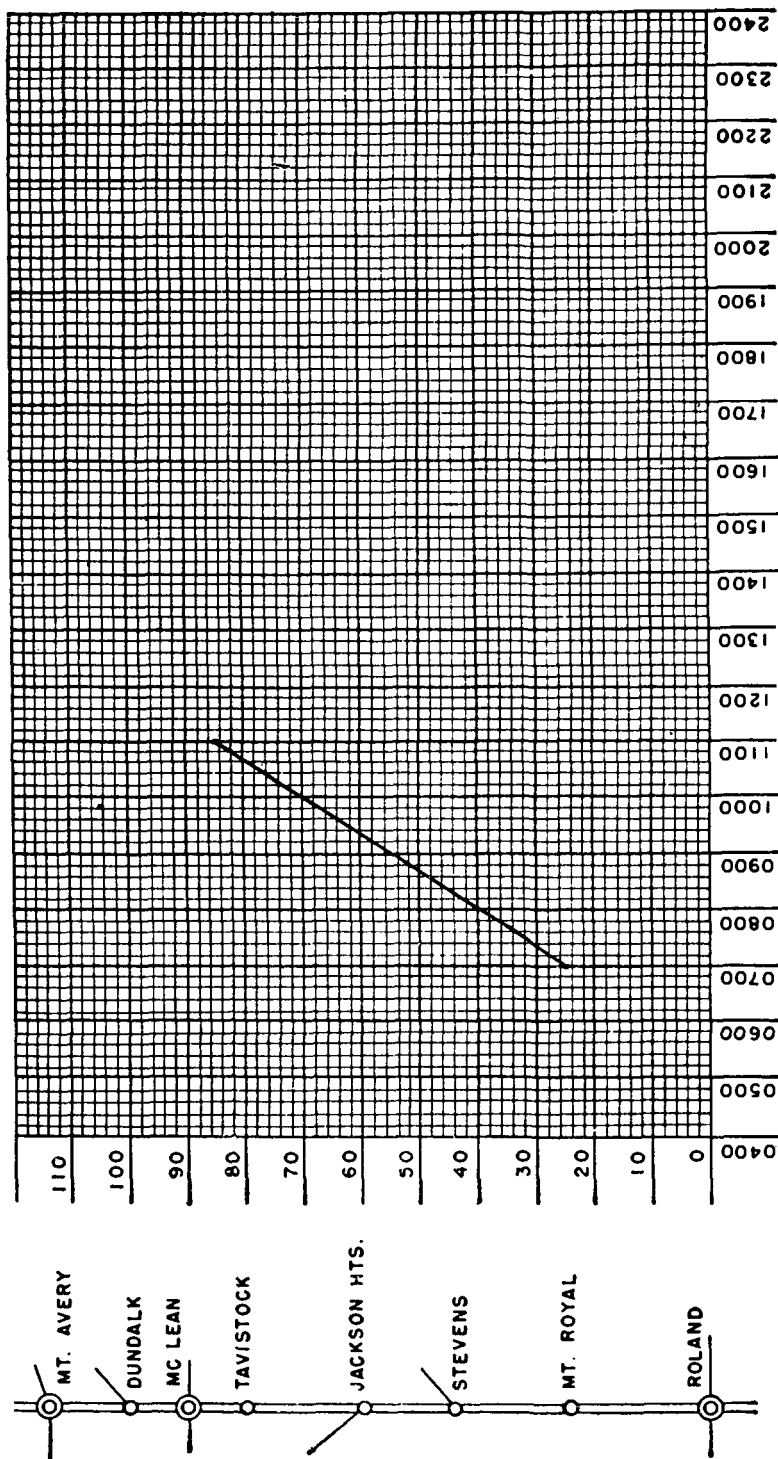


Figure 2. Schedule of heads of column.

point 3 miles beyond Tavistock at a rate of 15 miles per hour. The distance is 60 miles, and the march will thus take 4 hours. In figure 3, the lower end of the oblique line represents the start point and starting time. The upper end represents the destination and the time when the head of the column will reach it. The line itself represents the scheduled progress of the head of the column between the two points.

b. *Scheduling the tail of the column.* Unless the march column or element is very short both the head and tail should be plotted on the graph. Therefore, after the head has been scheduled the tail is also scheduled if the time length of the column can be determined. Assuming that the time length of the column in this example is 30 minutes, its clearance time will be 0730 at Mount Royal and 1130 at the destination north of Tavistock. In figure 3, therefore, the scheduled progress of the tail of the column is shown by the oblique line furthest to the right (30 minutes later along the time scale). The lower end of this line represents the clearance of the tail at the start point, and the upper end represents its clearance at the destination. The horizontal distance between the two lines represents the time length of the column. The other dimensions and distances are as indicated in the figure.

96. Scheduling Several Columns Over the Same Route

The road movement graph also provides a means for scheduling several columns or serials over the same route in an orderly manner. The commander of an organization which is moving in several elements or a highway regulation officer can prepare an outline graph in advance for a given period or group of movements and can then keep accurate records by completing the graphs as the various elements actually progress along the route. Colored pencils, crayons, ink, or tape can be used to indicate various elements, schedules, priorities, actual progress, and so forth. Changes and adjustments can then be made as necessary as the various movements progress. Figure 4 shows a preliminary graph prepared in advance for a particular group of movements. If these movements were to progress on schedule, there would be no interference between them. However, there are many factors which might cause changes to become necessary. Figure 5 shows the same movements

as they might be completed if certain changes were required. The actual marches shown in the completed graph (figure 5) occurred as follows:

a. *Serial A.* Serial A completed its march as scheduled with no deviation from the plan indicated in figure 4.

b. *Serial B.* Serial B received a change in orders directing that it continue on to Dundalk. It continued on schedule, and the head of the column reached the destination at 1200.

c. *Cross road lateral movement.* The cross road lateral movement (not identified as a serial) was required to wait at McLean to avoid interference with Serial B under its changed orders. The lateral movement made its noon halt, crossed the north-south route 3 hours behind its planned schedule, and did not clear its destination until 1830. Interference at the critical intersection, however, was avoided.

d. *Serial C.* At 1200 it became apparent that if Serial C continued on schedule it would interfere with the already delayed lateral movement at about 1730. It was, therefore, stopped from 1200 to 1400. Because of its low priority, it was then directed to continue at a slower rate of march until 1700 when it was again halted to let all elements of Serial D pass.

e. *Serials D and E.* These serials completed their marches according to schedule.

97. Road Movement Tables

Road movement tables are a convenient means of transmitting to subordinates their schedules and other essential detail pertaining to a road move. This is particularly true in cases where the inclusion of such detail in the body of the operation order would tend to complicate it or make it unduly long. Road movement tables will consist of two parts, the first being 'data' paragraphs reflecting general information or information common to two or more serials. The second part is a list of serials together with all other necessary information, arranged in tabular form. The security classification given road movement tables will be in accordance with the contents, not necessarily the same as that given the operation order. A wider distribution will normally be given to road movement tables than that given the operation order so that copies can be issued to personnel involved in regulation and control, as well as those having command responsibilities.

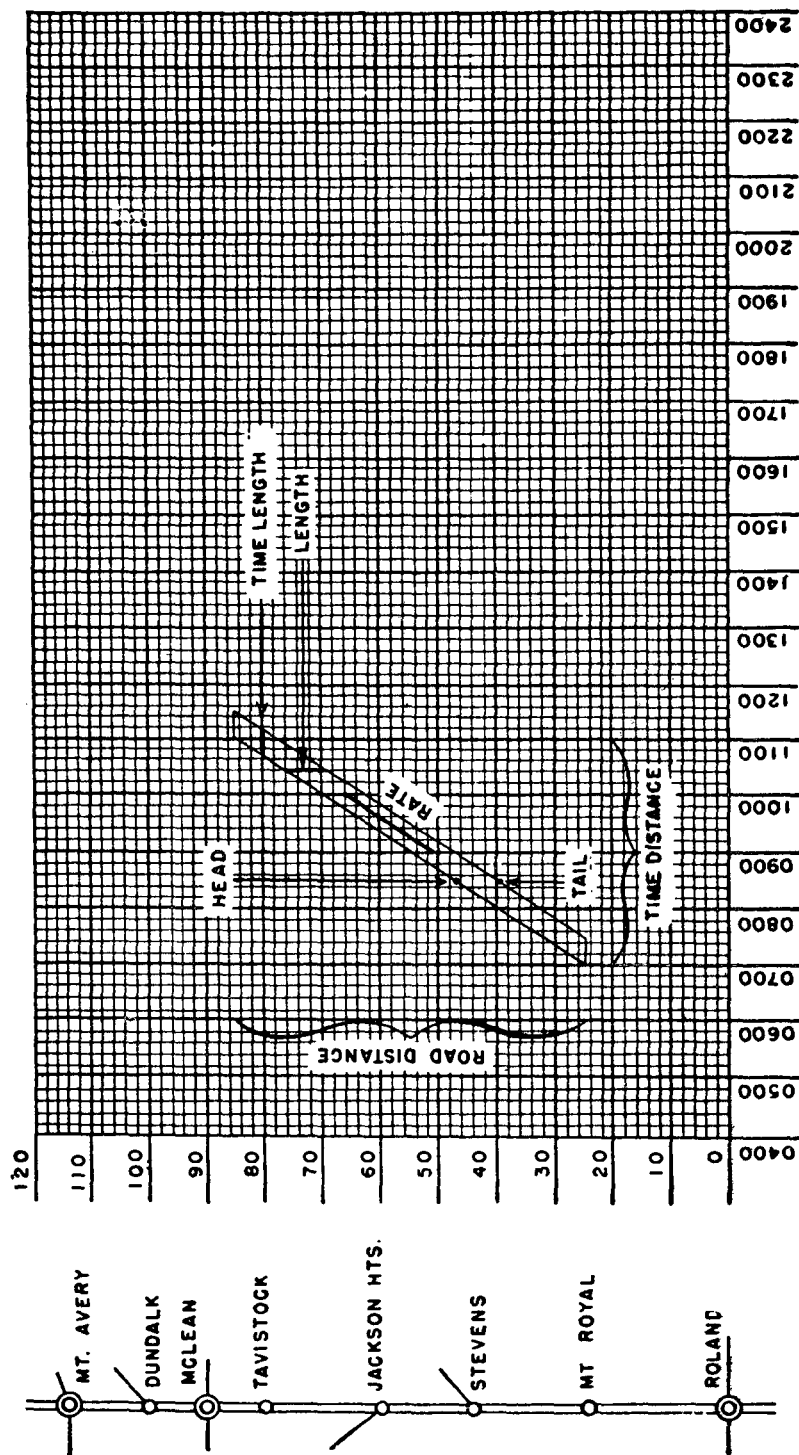


Figure 3. Analysis of graph.

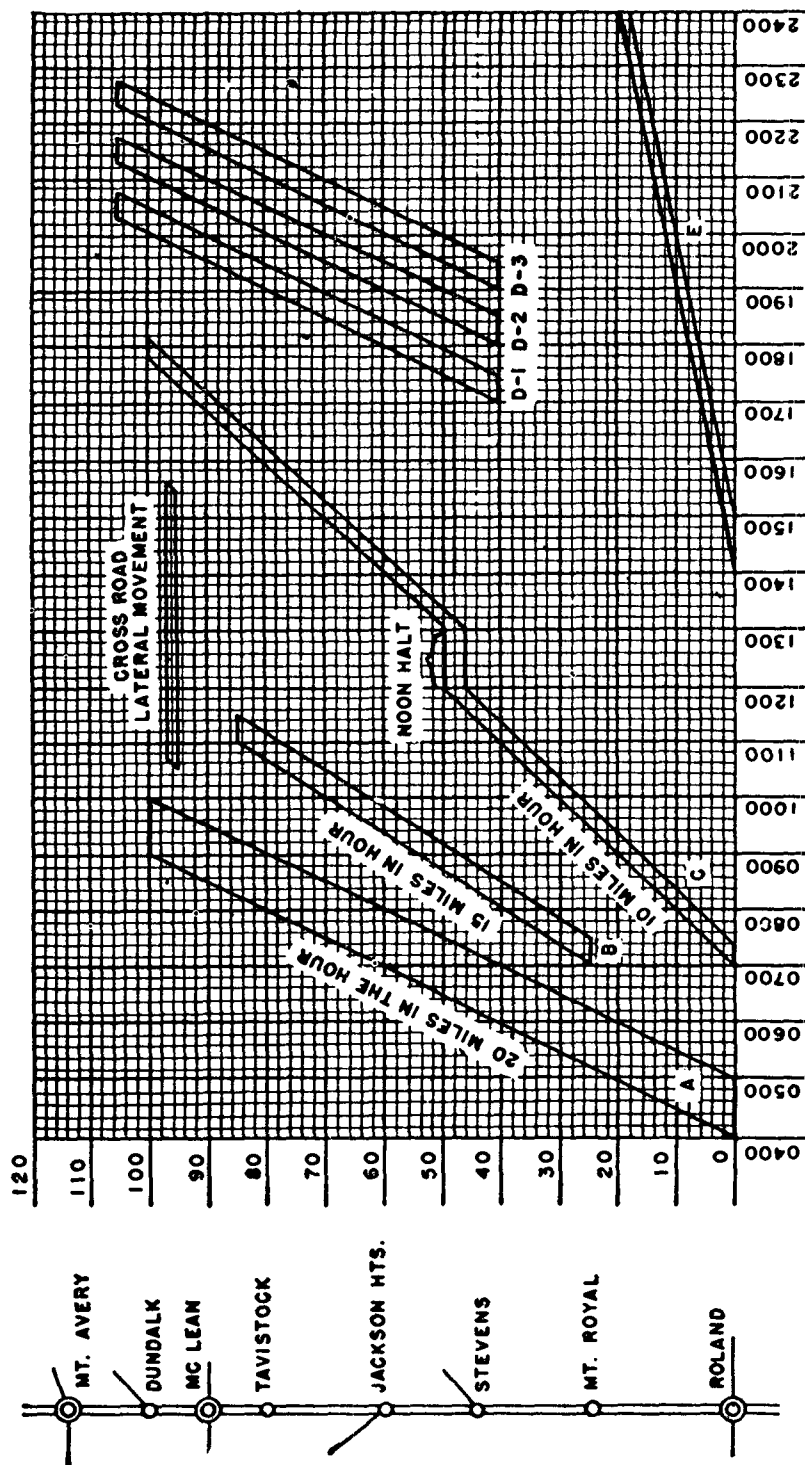


Figure 4. Scheduling several columns over the same route.

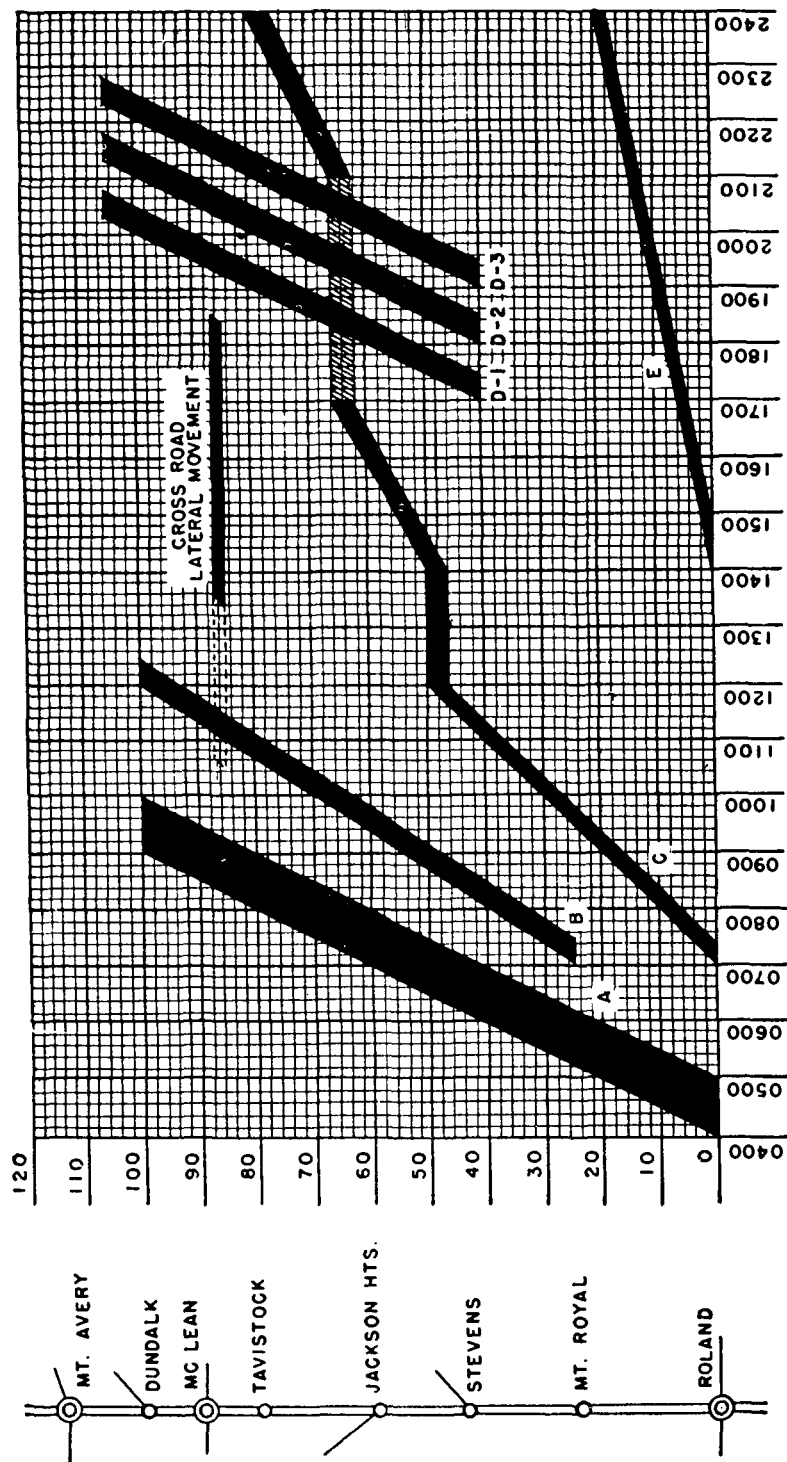


Figure 5. Schedule adjustments.

(SECURITY CLASSIFICATION)

Annex _____ to _____ (Formation/Unit)
Operation Order No. _____
Dated _____

Maps _____

1. Average speed
 2. Traffic density
 3. Halts
 4. Routes (between start points and release points may be indicated by code—red, green, etc.)
 5. Critical points ¹
 - a. Start points
 - b. Release points
 - c. Other critical points
 6. Main routes to start points
 7. Main routes from release points
- These routes and points are here described by grid references, code words, etc., and, if necessary, numbered or lettered for ease of reference in the columns below.

Serial ² (a)	Date (b)	Unit/Formation (c)	Number of vehicles (d)	Load class of heaviest vehicle (e)	From (f)	To (g)	Route (h)	Route to start point (i)	Critical points ¹			Route from release point (m)	Remarks ³ (n)
									Location (j)	Due (hr) (k)	Clear (hr) (l)		
1	1 Sep	1st BG, 86th Inf (Motor elements, close column).	142	21	Alfa	Bravo	Red	71	RJ 620 (SP) CR 212 CR 427 CR 442 (RP)	0001 0021 0041 0118	0019 0039 0059 0136	11	None

¹ Critical points are selected points along the route used for reference in giving instruction. These points include start point, release point, and other points along the route where interference with the movement may occur or where timing is critical.

² A movement serial is defined as an element or group of elements within a series and in this table has a numerical designation for convenience in planning, scheduling, or control of movement.

³ Information which is common to two or more serials will be given in the beginning of the table, items 1-7.

Figure 6. Road movement table.

98. Critical Time and Point Graph

The critical time and point graph may be used by the headquarters responsible for the movement of numerous columns over a limited road net. This aid will speed the consolidation of road movement graphs of subordinate units to facilitate the resolution of conflicts at critical points.

a. The critical time and point graph consists of a separate graphic chart for each selected critical point. These charts are divided into four sections representing the directions of column movement and into time segments to represent a 24-hour period.

b. To use the critical time and point graph, the period of occupation of each numbered critical point is determined from the road movement graphs of units using the road net during the

period shown. As this information is plotted, conflicts will become apparent. Separate convoys or columns may be identified by symbols or colors in lieu of shading as shown in the example.

c. To demonstrate the use of the graph, three numbered critical points have been selected and identified on the graph. A convoy traveling east will occupy critical point 25 from 0015 to 0030. It will occupy critical point 26 during 0130-0145 where it changes direction to move north. Between 0245 and 0300 it will occupy critical point 35. With this information plotted on the graph, possible conflicts will become apparent as information of other movements is plotted and provisions for adjustment may be made with a minimum of delay.

Section IV. DEVELOPMENT OF UNIT SOP'S

99. General

Standing operating procedures are prepared by units, usually down to and including those of company size, to simplify the preparation and transmission of orders; to simplify and perfect the training of troops; to promote understanding and teamwork between commander, staff, troops, and installations; to facilitate operations, both tactical and administrative; and to minimize confusion and errors.

100. Requirements

The requirements for, and the scope of, unit SOP's vary with the size of the unit concerned, its organization, and its normal missions. Certain prerequisites, however, are common to all units. These include conformity with the SOP of the next higher unit, sufficient flexibility to allow addition or deletion without demanding major revision, sufficient detail to avoid ambiguity, and avoidance of repetition of material contained in field manuals available to the unit.

101. Responsibilities and Procedures

The initial draft of the unit SOP normally is drawn up during the initial training phase of the unit by the G3 (or S3) in cooperation with other members of the unit staff. This initial draft is modified as the training of the unit

progresses and its requirements become known. Normally the initial draft states the requirements specified by that of the next higher unit with a more detailed operational procedure for the unit concerned.

102. Items Covered in Movement SOP's

The following items may be included in the unit movement SOP:

- a. Standard organization of columns for movement, including the grouping of vehicles and specification of group commanders as applicable.
- b. Composition and duties of the advance party or reconnaissance echelon.
- c. Priorities of movement of columns or elements.
- d. Responsibility for manning start point and release point.
- e. Discipline en route, use of lights, and procedures at halts.
- f. Traffic densities and speeds.
- g. Posting of guides and markers and traffic control measures.
- h. Normal vehicle loads, including personnel.
- i. Action in the event of enemy attack and passive defense methods.
- j. Supply, maintenance, and evacuation procedures.
- k. Communications, required reports, and liaison methods.

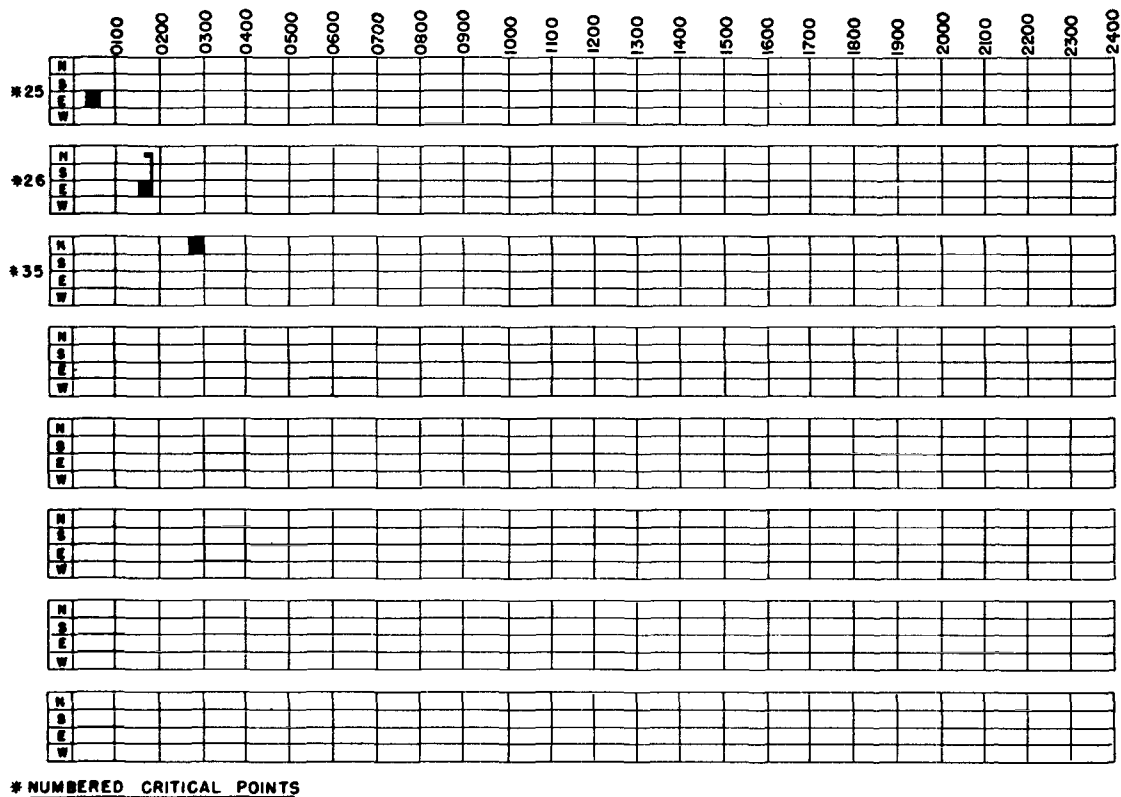


Figure 7. Critical time and point graph.

l. Location of medical facilities along route of march.

103. Form of Publication

The unit SOP may be prepared in the form most convenient for the purpose of the unit con-

cerned. Smaller units normally prepare an SOP covering all functions of the unit in either pamphlet or looseleaf form. Larger units may prepare separate pamphlets for diverse functions, issuing only those applicable to specific subordinate units.

PART FOUR

OPERATIONS UNDER ADVERSE CONDITIONS

CHAPTER 8

OPERATIONAL ENVIRONMENT

Section I. GENERAL

104. Characteristics

The operational environments of mobile ground warfare is a combination of existing highway facilities, terrain, climate or weather, and enemy actions. Adverse operational environments are those in which the combination constitutes a major problem in tactical maneuver or logistical support. The problem may be caused by lack of highways and bridges capable of carrying normal military loads in sustained operations, by terrain that limits vehicular movement or weather that inhibits movement, or by direct or indirect influence of enemy action. The timely and accurate evaluation of this combination in relation to available transport vehicles is a major factor in the success of any military operation. Operational environments

must be considered in the planning of individual and unit training and in the selection of equipment as well as in the planning of tactical movement and logistic support.

105. Common Planning Factors

Since the possible combinations constituting operational environments are extremely varied and may be only local in effect, detailed descriptions of specific environments and solutions for the problems they cause are beyond the scope of this text. Paragraphs 106-118, however, are intended as an aid to personnel at all echelons in meeting these problems—a checklist of common planning factors with their general effects in combination and the basic techniques of operation, to include off-road.

Section II. HIGHWAY NETWORK

106. General

The determination of requirements for motor transport to support military operations in any given area is based to some degree on the amount, type, and condition of existing highway facilities in that area. The highway network of any theater is used to the greatest extent practicable. Increased tonnages, rapid movement of combat troops, and increased depth of the combat zone are basic considerations in modern warfare. Together, they dictate increased employment of motor transport. An im-

proved highway system with adequate surfaces and bridges will facilitate the movement of troops, equipment, and supplies as long as the system remains intact. Preliminary planning may be done from civilian road maps of the area giving general alinement, comparative surfacing, and some information on bridges and tunnels. This, however, must be supplemented by detailed information from other sources if operations are to be sustained. Topographic maps, air photographs, ground reconnaissance, reports of travelers or inhabitants, and con-

struction plans of highways and bridges serve as sources for further information.

107. Highway Characteristics

Although the term "highway" is normally associated with an improved, hardsurfaced, through route, military plans must consider through roads of any class as highways—or possible highways. Highway characteristics include all elements of design and construction which influence vehicular travel. These include—

a. Width of Road. This characteristic determines the size of vehicles and lanes of traffic that may be accommodated.

b. Type of Road. This is normally determined by the surface material and type of construction and is classed according to capabilities as *all-weather*, *limited all-weather*, or *fair weather*. Consideration is given to grades, alignment, drainage, and foundations as well as surface materials.

c. Military Load Classification. This classification is based on the heaviest class of vehicle that can use the road in convoy and usually corresponds to the bridge with the lowest classification on the route.

d. Obstructions. Obstructions may be natural or artificial and include features, limited in extent, that may cause bottlenecks or slow down movement on a particular segment of road. They include reductions in overhead clearance or road width caused by tunnels, bridges, or overhead wires; overhanging or encroaching buildings; watercourses where the means of crossing—bridges, fords, or ferries—have less capacity than the road; steep grades and sharp curves that materially reduce the speed of traffic; and blockage by snow or flooding.

108. Highway Evaluation

The results of highway evaluation indicate to some extent the difficulty of a given operational environment for motor movement. True "cross-country" (beeline, point-to-point) movement is seldom attempted by any military motor vehicles except tracked combat vehicles organic to battalions or smaller units when in contact with the enemy or when contact is imminent. Motor transport vehicles will normally use roads, trails, or tracks whenever available. Highway evaluation at any level in an active theater is more than a review of the road network, surface treatments, and bridge capacities. The current existence of adequate highway facilities is no guarantee of a sustained favorable operational environment. Weather and both friendly and enemy activity, in combination with terrain and highway characteristics, may cause sudden changes. Highway evaluation must, therefore, include degrees of sensitivity. For example, in the more developed areas of the north temperate zone, climatic requirements for highway construction provide a road net with a high peacetime traffic capability—road surfaces comparatively impervious to moisture and resistant to the effects of snow and ice, grades and surface drainage well designed and carefully prepared, and deeper, better drained base courses. Terrain exerts a similar influence on highway construction. In general, difficult terrain problems are met by careful highway planning and construction while unimproved roads may serve adequately in areas of good off-road trafficability. Bypassing areas of highway damage under extreme conditions of climate and terrain will require either the employment of heavy engineer equipment or transport vehicles with a high degree of off-road capability and well-trained, experienced drivers.

Section III. CLIMATE AND TERRAIN

109. General

The influence of climate and terrain on motor movement increases in direct proportion to the requirements for off-road or cross-country operations. Although some effects of climate on motor operations may be considered separately, consideration of this factor normally will be a part of terrain evaluation. Terrain evaluation

is the study of landforms, soils, climate, and vegetation in relation to the employment of military units and equipment in a given situation. The ability to move vehicles and equipment without interruption and with minimum exposure to observation and direct fire depends largely upon the skillful use of terrain. Skillful use of the terrain, in turn, depends on prompt

and realistic terrain evaluation by personnel at all levels from the driver to the commander.

110. Climate

Climate is the condition produced by the factors of temperature, humidity, precipitation, wind, and light in a given area over an extended period. Weather is the local, day-to-day condition of the atmosphere. Long range plans for a theater of operations are concerned with climate; local daily operations are concerned with weather. Extremes of climate influence motor operations by effects on personnel and equipment. Cold climates reduce the efficiency of personnel with the requirement for bulky clothing that limits movement in the performance of maintenance and operational duties. Hot, humid climates affect personnel in the reduction of energy and efficiency through physical discomfort and in the increase of bacterial disease and problems of sanitation. Extremes of temperature affect both the operation and the maintenance of motor vehicles. Low temperatures require protection of cooling systems to prevent freezing, fuel additives to prevent the formation of ice in fuel lines, and modification or protection to facilitate starting. Tire life may be reduced by continued exposure to low temperatures. Metals may become brittle and break under comparatively light shock. Battery efficiency is greatly lowered, and care must be taken to prevent freezing and cracking. Extremely high temperatures complicate problems of engine cooling, and breakdowns from overheating are common. Heat combined with high humidity reduces the life expectancy of all equipment and adds to the problems of maintenance, repair, and replacement. Rust and corrosion of metals is accelerated. Mildew and rot rapidly attack unprotected cloth and leather products. Where severe freezing occurs, extensive road maintenance may be required after each thaw, particularly in early spring.

111. Terrain

Terrain is the combination of landforms, vegetation, soils, and drainage. The results of this combination are broadly classified as mountains, badlands, hills, and plains. Mountains present major all-weather obstacles to military motor operations—steep grades, sharp curves, defiles, and distinct compartments. Badlands

are characterized by a topography of pinnacles, steep buttes, and sharply eroded ravines or canyons. Although elevations of badlands are less than those of mountains, off-road operation of motor vehicles is extremely difficult if not impossible. Hills may be considered as normal terrain in many sections of the world, particularly in the developed areas. Lower elevations, less steep grades, better alinement of roads and highways, and more moderate drainage reduce the difficulties of motor movement in hilly areas, both on- and off-road. The variety of elevation and presence of normally trafficable soils offers a choice of off-road routes to give more flexibility in planning. Plains, covering the greater part of the land surface of the world, offer few obstacles to military motor movement under average conditions.

112. Combined Effects

Adverse conditions for motor vehicle operation and military motor movement are usually caused by combinations of terrain, climate, and weather. The effects of climate on terrain include the amount and character of vegetation, the amount and frequency of precipitation, the average moisture content of soils, and the size and type of water obstacles. Weather conditions may reduce highway speeds, increase congestion, and be a major cause of accidents. Fogs, rain, snow, ice, and high winds restrict movement on highways as well as cross-country. In planning off-road movement and movement on unimproved roads and trails, the type and character of soils must be considered in conjunction with climate and weather. Vegetation may serve as an indicator of soil type and trafficability. It may also constitute an obstacle to movement even though it provides cover and concealment. Soils are complex combinations of disintegrated rock in the form of sand or clay and disintegrated organic material (humus). Their capacity to carry traffic is dependent upon structure and the effect of moisture. Generalizations as to conditions and resultant trafficability must be tempered by experience in making evaluations. The following briefly outlines major soil characteristics and the effects of climate and weather. Snow characteristics are included since the effects of snow on motor movement are considered in the same manner as soil effects.

a. Mud. Clay and silt are the basic ingred-

ients of mud and all soils containing these substances in appreciable amounts will become muddy when wet. Clay, however, dries hard and firm, becoming in hot, dry seasons almost as hard as paving. A sudden shower may give it a greasy surface and destroy traction. Longer exposure to moisture produces sticky mud in increasing depth that may prevent any wheeled vehicle traffic. The weight of vehicles and the movement of tracks or wheels produce a kneading action that, in the presence of moisture, softens clay. Normal topsoils are mixtures of decomposed vegetable matter and clay, silt, or sand. Their trafficability depends upon the proportions involved. In some areas the various combinations may be readily recognized by their color and consistency.

b. Sand. Sand is loose granular material resulting from the disintegration of rocks. Fine sands give excellent support and traction when firmly compacted and dampened. Coarse sands dry rapidly, do not compact readily, and may usually be classed as an obstacle to motor movement.

c. Snow. Although snow may be treated in the same manner as soil in terrain evaluation, the effects of snow are more difficult to predict since no other traffic surface is as variable in structure or as sensitive to temperature change. Snow *conditions* are more important in determining trafficability than snow depth because comparatively minor changes in temperature or sunlight may have major influence on vehicle movement. The trafficability of snow is judged by its strength, traction, and resistance. Strength and resistance is determined primarily by structure. A light new-fallen snow up to 20 inches in depth offers no serious obstacle to the average military vehicle while an eight-inch fall of grainy, sand-like "sugar snow" will make wheeled vehicle operation very difficult, if not impossible. The traction afforded by snow depends to a great extent upon temperature. Under conditions of extreme cold, snow offers

about the same traction as dry soil. Near freezing temperatures, however, reduce traction on hard packed surfaces to practically zero.

113. Terrain Evaluation

Terrain evaluation relates all factors of the operational environment to the capabilities and limitations of the task equipment. In all military motor transport operations, terrain evaluation should be habitual. In active theaters, evaluations should be made for both highway and off-road operation. The source of information, the techniques, and the results of terrain evaluation vary with the echelon of interest. For long range planning at higher staff levels, sources of information include meteorological records, climatology texts, topographic maps, soil maps, geologic maps, air photos, reports of travelers, interviews with former residents, and interrogation of prisoners. Techniques are based on comparative studies of a large area. The results of high-level terrain studies are broad in scope, general in nature, and are intended to give guidance for the duration of a major operation. On the other hand, terrain evaluation at driver level is made to select the most suitable route or technique of operation to solve a specific local problem—to accomplish the mission most effectively under the circumstances. It is based upon information gained from personal observation and ground reconnaissance, aided and extended by maps, photos, and local intelligence. This information is weighed against known capabilities and limitations of the vehicle and the training or personal experience of the driver. The scope is limited, and the results are immediate. Weather, rather than climate, is considered the most important variable. Even in a well-developed area with a good road net, the driver may be required to make an off-road detour to bypass a roadblock or section of damaged highway. The habit of constant terrain evaluation enables him to make a quick decision and prompt selection of the most practical route.

Section IV. INFLUENCE OF COMBAT CONDITIONS

114. General

The influence of combat conditions, both direct and indirect, must be considered in the planning and execution of all motor movements in active theaters of operations. The degree of

mobility demand by concepts of modern warfare and the extension of means have increased the importance of this factor in the communications zone as well as in the combat zone. The activities of a determined enemy may prohibit

the use of some highways. Under such conditions, the off-road capabilities of available vehicles must be exploited to the utmost. Adequate security, timely and accurate information from the intelligence service, and counter-measures by friendly combat forces will reduce the effects of these enemy activities. Alternate routes will normally be planned to bypass critical areas.

115. Direct Interference

The enemy may influence motor transport operations directly by long-range fires, by guerrilla or partisan activities, or by the action of combat troops. In modern war this direct interference may affect movement anywhere in the theater of operations. Long-range weapons, to include missiles and airborne weapons, can be used at will against established targets. The enemy may employ these long-range weapons for destruction, neutralization, harassment, or interdiction. As affecting motor transport, fires of destruction would be normally limited to easily identified fixed targets such as bridges, tunnels, and buildings used as headquarters or terminal facilities. Neutralization fires may be planned to reduce or deny movement in a particular area and may be employed effectively against off-road motor transport operations in rough terrain to deny the use of covered or concealed routes. High explosives, smokes, and illuminants may be used as appropriate. Harassing fires would normally be used against motor transport only in highway operations. Intermittent fires on lines of communications at defiles, crossroads, or other critical points will effectively reduce the efficiency of highway motor transport with a minimum expenditure of ammunition. Interdiction fires, of less intensity than either destruction or neutralization fires, are used to deny the use of established routes intermittently or for specific periods. The effect of long-range artillery on motor transport is to increase the requirement for off-road operation. The use of rockets or guided missiles is similar to that of long-range artillery but, due to lower availability and increased complexity of firing techniques, rockets and missiles would probably be employed less against motor transport operations. Aerial bombardment or strafing may offer a serious threat to both highway and off-road motor transport operations where friendly air

cover is either absent or inadequate. Attack aircraft are well-suited for employment against targets of opportunity—and loaded supply vehicles offer lucrative targets with little means of defense.

116. Guerrilla or Partisan Activities

Mobile warfare normally generates increasing guerrilla and partisan operations. Long lines of communication carrying supplies and replacements to combat forces are extremely vulnerable to attacks by indigenous forces. Guerrilla tactics may include destruction, interdiction, harassment, and every conceivable combination of these. With the dual objective of interrupting the flow of supplies to combat units and of immobilizing large numbers of combat troops, the guerrilla force will strike wherever and whenever the opportunity is presented. Guerrilla forces are best suited to operations in jungle, heavily wooded areas, or mountainous terrain where transport movement is limited to particular routes, off-road operations are greatly restricted, and cover and concealment is offered the attacking force. The variety of techniques employed will be limited only by training, equipment, and ingenuity of the attacking forces. Barriers, reinforced by mines and boobytraps, may be used together with troops in ambushes or may be used alone without protection as sources of annoyance and delay. Guerrillas normally avoid well-known or stereotyped tactics to gain surprise and maximum effect from their limited resources of manpower and materiel. The clandestine (hidden) activities of partisans, particularly if coordinated with overt (open) guerrilla operations, can seriously complicate transport problems. Partisan actions may be confined to critical points in the line of communication. Sabotage of vehicles and facilities at terminals or servicing areas may vary in degree from acts of harassment to total destruction. Motor transport personnel at all echelons must therefore be constantly alert to the conditions that invite sabotage and must maintain a tight security. Motor transport units should be as self-sufficient as possible in providing their own security since every request for combat troops to assist in defense against guerrilla or partisan operations recognizes the accomplishment of a part of the guerrilla mission (FM 31-15).

117. Direct Interference by Enemy Combat Troops

Direct interference by combat troops becomes more possible as the battlefield becomes more fluid. The dispersion required as passive defense against the threat of nuclear weapons has developed a pattern of coordinated operations of mobile, self-contained forces to replace the continuous line of mutually supporting combat units. This dispersion is also reflected in the size and location of administrative and supply installations in rear areas. The fluid battlefield and the dispersion of supply installations increase both the requirement for motor transport support and the threat of infiltration, airborne attack, and deep penetration. Main supply routes, as well as installations, may be included

as objectives for enemy combat units operating in rear areas.

118. Indirect Interference

The indirect effects of combat are evidenced by roads pock-marked by shell craters and worn by heavy military traffic, by temporary bridges and hastily constructed detours and bypasses, and by off-road routes established to bypass debris, blowdown, and uncleared mines. Requirements for emergency construction and repair may place a burden on engineer units beyond their immediate capabilities. Motor transport operations will consequently be slowed, and heavy demands will be made on vehicles and personnel to keep supplies and material moving.

CHAPTER 9

TECHNIQUES OF OPERATION AND CONTROL

Section I. GENERAL

119. Mission and Equipment Analysis

a. In planning any motor transport operation, the mission or assigned task must be related to the known or probable operational environment (the area in which the task must be performed). This relationship determines the required degree of vehicle mobility which, when balanced against the capabilities of available transport vehicles, indicates the difficulties of movement and control. The preceding chapter outlines the elements of adverse operational environments, the factors complicating problems of motor movement, and the results of their interaction. The following paragraphs will serve as a guide in the solution of these problems.

b. Vehicles available for any military motor movement may vary in capability from the jeep to the tractor-trailer combination of commercial

design. Efficient and economical use of motor transport depends on the selection of the most suitable available equipment for the completion of the assigned mission under the given conditions.

120. Unit Capabilities

The selection of motor transport units for the support of a specific operation or series of related operations is made on approximately the same basis as that of equipment—availability, capability, and efficiency. Commanders and their staffs must realize the limitations of available equipment and must also realize that units with prior training for operations in all environments are seldom available. Unit capabilities must be evaluated on the basis of past performance, training, and experience of personnel as well as on the amount, type, and status of organizational equipment.

Section II. DRIVER AND SMALL UNIT TRAINING

121. Relation Between Training and Equipment

The modern Army is equipped with a variety of motor transport equipment having a wide range of mobility. The increased variety of vehicles requires more specialized training for drivers and small units to get the maximum return from assigned vehicles. Units with vehicles of low off-road mobility must train their drivers in field expedients and vehicle recovery to maintain movement in emergency off-road operation and in operation under other unfavorable conditions. In units with vehicles having good off-road mobility, training in terrain evalu-

ation, land navigation, and selection of cross-country routes must be emphasized.

122. Basis of Training

Normally assigned missions, probable operational environments, and assigned task vehicles serve as the basis of training for motor transport personnel and units. Units are assigned and equipped to perform specific transportation functions in general areas of the theater of operations. In the communications zone, the motor transport intersectional service normally requires the most economical long haul equipment. High speed tractor-trailer combinations

are best suited for this purpose when a good highway network exists. Local motor transport services use lighter equipment of smaller capacity. In the combat zone, assigned task vehicles must meet increasingly difficult conditions as the support approaches the forward areas. General support units must have an emergency off-road capability. Though off-road operation may not be considered normal for these units, detours with poor trafficability may be used for long periods without improvement. Direct support units must have adequate capability for extended off-road operations under the most unfavorable operational conditions. Training requirements and operational techniques differ therefore to meet three general types of motor transport operations: highway operation with a limited off-road requirement, highway with the probability of extended off-road operation, and cross-country operation using roads and trails when possible.

123. Limited Off-Road Operations

The preparation of units and their assigned operating personnel for motor transport operations in the communications zone includes not only training in the operation and maintenance of vehicles under favorable conditions but also training to meet the most adverse conditions. Such units are normally equipped with task vehicles of limited off-road capability. Selection of equipment is dictated by the requirement for speed, economy, and high tonnage capacity. Prolonged operation of these vehicles under adverse conditions is unusual. Minor delays and inconveniences, however, are normal. The objective of all training to meet these conditions is to minimize their effect on the motor transport mission. Adverse conditions for communications zone units include the effects of mountainous terrain, poorly constructed or poorly maintained roads, climatic and weather conditions, and also any effects of combat requiring off-road operation beyond the normal capabilities of organic vehicles.

a. Highway Operation. Drivers completing their advanced driving under a comprehensive and well-supervised driver training program (TM 21-300) should be capable of meeting all highway conditions effectively. The drivers manual (TM 21-305) covers driving techniques and precautions for operating under most con-

ditions. Unit training should, in addition, prepare planning and supervisory personnel for the necessary adjustments in loading, scheduling, and selection of routes. Early phases of this training should include acclimatization and familiarization with the operational area.

b. Terrain Evaluation and Route Selection. Every driver should be trained to evaluate terrain in relation to the capabilities of his assigned vehicle. The driver of a truck-tractor semitrailer combination may never be required to move his vehicle off the pavement. Nevertheless, he should receive training in negotiating rough detours and bypasses and in selecting passable off-road routes. This training may mean the difference between success and failure in the accomplishment of his mission. This additional driver training in terrain evaluation and route selection should include the recognition of common landforms, the use of soil condition indicators, and a knowledge of the effects of weather on off-road trafficability. Continuous and directed training in the recognition of the relations between landforms, soil, drainage, and easily identified types of vegetation is essential to develop effective driver terrain evaluation. This training must emphasize the importance of following up preliminary route selections with dismounted reconnaissance to check the actual grades and the soil observation. His knowledge and experience, together with the habit of observing with both eyes and brain active, will speed his decisions in meeting emergencies and give him timely warning of enemy activity.

c. Field Expedients and Vehicle Recovery. Units equipped with vehicles which can normally operate only on roads often require the prompt and efficient use of field expedients and improvised vehicle recovery techniques to move off-road for even limited distance. Under conditions of modern war, the training of drivers and supervisory personnel of such units for this aspect of vehicle operation is often vital. Field expedients and improvised vehicle recovery operations depend on effective use of the materials and equipment usually available and on the ingenuity of personnel in combining principles, materials, and equipment to get the job done. Training in the principles of mechanical advantage and in the application of these principles using the equipment provided with the vehicle and other easily obtained items

should always stress the possibilities of substitution and improvisation. Additional information is provided in FM 20-22.

124. Extended Off-Road Operation

Transportation units operating between the field army service area and divisional units perform a higher percentage of off-road operations than units in the communications zone. Enemy interference, both direct and indirect, must be expected. Highways may be nonexistent, destroyed, or denied to use. Training for operations of this kind must stress the techniques of cross-country driving as soon as the driver has become reasonably familiar with his vehicle. Individual and unit training should include off-route reconnaissance and route selection, route improvement, control and communications procedures, and driver responsibilities.

a. Route Reconnaissance and Route Selection. The selection of supply routes for general support operations must be based on an evaluation of all factors of the operational environment. It may be assumed that enemy interference can be expected at any well-defined critical point, that priority will be given the most highly developed routes, and that supply operations may be subject to direct enemy observation. With these assumptions in mind, tentative route selections may be made from a thorough study of maps and air photos. Critical points and areas on the tentative routes may then be determined and plans made for bypassing them. When time permits, a route reconnaissance party should be sent over the route prior to dispatching the first cargo vehicle. This party can make necessary adjustments to insure continued movement and can also mark the route where necessary. Emergency detours of the less critical areas may also be reconnoitered to reduce delays in rerouting.

b. Route Improvement. In many cases route improvement will be necessary to cross areas of extremely low trafficability. While such areas are normally avoided in route selection, it may be advantageous because of cover and concealment to expend time and effort in improvement rather than to expose vehicles to enemy observation and fire. Training personnel in the use of pioneer equipment and in the preparation of reinforced road beds is advisable since engineer

troops and equipment may not be available for these projects. In addition, general support transportation units have more equipment suitable for route improvement and off-road operations than the units described in the preceding paragraphs. Training should emphasize basic principles and proper use of the equipment provided as well as the need for improvisation. Variations of the corduroy road, designed to distribute wheel loadings over greater areas, may be made of brush and saplings (corduroy fascine) or of bamboo. Other local materials that are readily available should also be used. In northern climates, even snow and ice may improve movement through barely trafficable areas.

c. Driver Responsibilities. The training of individual driver for general support motor transport operations must prepare him to assume greater responsibility than is required in more routine operations. As the forward areas of the combat zone are approached and off-road operation becomes more common, problems of control and communication force the motor transport commander to rely more and more on the training, skill, and judgment of his drivers. The wide dispersion of highly mobile units requires the delivery of supplies and equipment in comparatively small quantities to many destinations. Resupply vehicles may be dispatched singly or in small groups over routes that may include roads, trails, and cross-country operation. Both the driver and his assistant must therefore be well-trained in all phases of operation. They must know their assigned vehicle—its operation and maintenance, capabilities, and limitations. They must also have a *working* knowledge of the factors of terrain, weather, and combat conditions as they affect the accomplishment of the assigned mission. Both must be able to read and interpret maps and air photos and must be trained in land navigation. Drivers and their assistants should be briefed before they are dispatched individually or in small groups. This briefing should definitely locate their destination, prescribe routes to and from the destination (if practicable), point out critical points or areas, show emergency detours, and specify measures of control. Unit SOP's should include defense measures and procedures for reporting enemy activity, and drivers and assistants should also be instructed

on these points. It must be emphasized to the driver that, when he is individually dispatched, he is responsible for following the prescribed route, making emergency adjustments as required by the situation, and staying within the limits of the prescribed schedule.

125. Direct Support Operations

Direct support of combat units by motor transport imposes the greatest requirement for off-road vehicle capability. The mobility of transport vehicles so assigned should equal or closely approach that of the most mobile vehicle of the supported unit. The resupply of ground combat units in a mobile situation demands such organizational flexibility that economy may be considered secondary. Experience factors show that the daily requirements of a division for logistical support transportation capability vary from less than 100 tons to nearly 500 tons depending upon the situation and the type of operation. The resupply of subordinate dispersed units is subject to comparable variation. In addition to variation in tonnage, cargo characteristics also vary. Motor transport units customarily in direct support must be equipped and trained to accomplish these varying missions under cover of darkness or subject to enemy observation and fire and with a minimum use of prepared roads. The following factors should be considered in planning individual and unit training.

a. Route Selection Limitations. The problems of route selection for direct support motor transport operations are similar to those outlined in paragraph 124, but they are further complicated by the proximity of the enemy, the reduced trafficability of the areas concerned, the reduced time available for planning, and the higher percentage of individually dispatched vehicles. Each of these limitations imposes an increased responsibility on the driver or vehicle crew and, therefore, an increased training requirement. The proximity of the enemy increases the need for additional driver training in the use of cover and concealment and in the conduct of night motor transport operations. The trafficability of areas further to the rear may be determined from a study of maps and air photos and from a review of information gathered in the field; forward area trafficability, however, is subject to rapid and violent change due to the maneuver and contact of combat

units and must be determined on the ground at the time of passage. The almost constant movement of combat units maneuvering for advantage on a fluid battlefield precludes the early establishment of resupply points. The location of a supported unit, usually given as a map coordinate, may not be provided to the supporting unit until the supply vehicles are ready to move out. Conditions of mobile warfare may require the customary dispatch of individual supply vehicles due to the distances involved and to the reduced size of the widely dispersed combat units. Route selection under these conditions may be limited to a hasty map reconnaissance by the dispatcher and vehicle crew to determine direction to the destination and areas of reduced trafficability. Deviations from the selected route as required by conditions and necessary corrections for these deviations are responsibilities of the driver and are based upon his judgment and training. Since the success of combat units in mobile warfare may depend on their ability to maneuver rapidly to meet changing situations, their supporting services must achieve a comparable degree of flexibility. Effective resupply demands the selection of routes offering good trafficability to allow vehicles to proceed without delay, sufficient cover and concealment to protect cargo and vehicles from enemy observation and fire, and enough definition (landmarks; changes in terrain) to allow travel during hours of darkness.

b. Cargo Characteristics and Delivery Factors. The characteristics of motor transport cargo may change as supplies approach the consumer. While the bulk of dry cargo carried by motor transportation in rear areas will be largely in containers or on pallets for efficient delivery, that being transferred to combat units will more generally be loose. Supplies with a predictable and fairly constant consumption rate (particularly class I) may, however, be pallet-mounted for ease in handling and delivery to units on a prearranged schedule. Supplies of other classes (POL, ammunition, fortification materials, etc.) have extremely variable consumption rates, constitute a large percentage of the tonnage requirements for a unit in contact, and demand either the reconstitution of prescribed loads of distribution to meet special requirements of specific operations on request and with minimum delay. Mobile combat places unusually heavy requirements of fuel-servicing

vehicles and may require the movement of these vehicles at any time. High density cargo, such as ammunition and related items, is usually carried to forward units as loose cargo. It requires additional manpower for unloading and often must be delivered on an emergency basis under the most adverse conditions. In addition to the factors outlined in the preceding paragraphs, direct support transportation also is greatly influenced by delivery factors—time, distance, and labor at destination. Although these factors must be considered in all transport operations, they become increasingly important in this final phase of distribution. The decision to use a single high-capacity vehicle to make deliveries to several units or to dispatch smaller vehicles on individual missions depends on consideration of these factors. In addition, modification of time and distance factors may be necessary to allow for route adjustment and delays due to enemy interference. Assuming that the time and distance factors allow multiple delivery, sufficient labor and equipment must be available at each destination to unload a portion of the cargo and to rebalance the load if necessary before the vehicle continues on the mission.

c. Driver Responsibilities. The driver assigned to direct support operations must possess the skills and sense of responsibility outlined for the general support driver developed to an even greater degree. He should also be well trained in all the basic combat skills. In normal operational environment, the direct support driver is required to react promptly and correctly to situations as they arise, to protect the cargo and vehicle both actively and passively, and to use communications properly.

d. Assistance From Supported Units. Supported units may give their supporting motor transport units valuable assistance by supplying information on possible routes to their positions, current conditions en route, and in supplying guides or markers where feasible. Information

on the enemy, however, normally is supplied through regular intelligence channels.

126. Control and Communications

The effective control of motor transport movement in adverse operational environments is mainly dependent on training and communications. Direct supervision under adverse conditions is often difficult if not impossible. The emphasis on mobility and dispersion resulting from modern weaponry places an increasing burden on communications. Although communication equipment and techniques have kept pace with these changes, complete dependence upon electronic means, particularly in forward areas, is often impractical. Limited availability restricts the allocation of equipment and personnel to support elements. Traffic over available radio channels under combat conditions must be rigidly controlled, with administrative traffic restricted to that essential to tactical operations. Combat units in forward areas receive priority in channel assignment since the degree of responsiveness to command determines the success of the operation. In addition, conditions of weather and terrain often interfere with radio transmission and reception. Communications service between transportation corps units is provided by the theater army communications system in the communications zone and by the army area communications system in the rear areas of the combat zone. In addition, highway base radio stations are operated by signal units for headquarters in the communications zone to provide traffic control for vehicles equipped with two-way radios. When radio equipment is authorized, driver training must include familiarization with the assignment and use of signal equipment and with communications systems. Adequate control SOP's must be developed by motor transport units to compensate for organic limitations and to take maximum advantage of auxiliary means of communications under all conditions.

APPENDIX

REFERENCES

1. Field Manuals

FM 5-20	Camouflage, Basic Principles and Field Camouflage.
FM 5-34	Engineer Field Data.
FM 5-35	Engineers' Reference and Logistical Data.
FM 5-36	Route Reconnaissance and Classification.
FM 8-35	Transportation of the Sick and Wounded.
FM 9-3	Ordnance Direct Support Service.
FM 19-25	Military Police Traffic Control.
FM 20-22	Vehicle Recovery Operations.
FM 21-5	Military Training.
FM 21-6	Techniques of Military Instruction.
FM 21-26	Map Reading.
FM 21-40	Small Unit Procedures in Nuclear, Biological and Chemical Warfare.
FM 21-41	Soldier's Handbook for Chemical and Biological Operations and Nuclear Warfare.
FM 21-48	Chemical, Biological, and Nuclear Training Exercises and Integrated Training.
FM 27-10	The Law of Land Warfare.
FM 30-5	Combat Intelligence.
FM 30-7	Combat Intelligence Battle Group, Combat Command and Smaller Units.
FM 30-10	Terrain Intelligence.
FM 31-25	Desert Operations.
FM 31-70	Basic Cold Weather Manual.
FM 55-4	Transportation Movements in Theaters of Operations.
FM 55-6	Transportation Services in Theaters of Operations.
FM 55-8	Transportation Intelligence.
FM 55-31	Motor Transport Service in Theaters of Operation.
FM 100-5	Field Service Regulations; Operations.
FM 100-10	Field Service Regulations; Administration.
FM 101-5	Staff Officer's Field Manual: Staff Organization and Procedure.
FM 101-10	Staff Officer's Field Manual: Organization, Technical, and Logistical Data.

2. Technical Manuals

TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 9-2800	Driver Selection and Training, Wheeled Vehicles.
TM 21-300	Military Vehicles.
TM 21-301	Driver Selection Training and Supervision; Tracked Vehicles.
TM 21-305	Manual for the Wheeled Vehicle Driver.
TM 38-660-1	Operation of Transportation Motor Pools and Driver Preventive Maintenance of Administrative-Use Vehicles.

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TM 38-750 The Army Equipment Records System and Procedures.
(SRD) TM 39-20-12 Transportation and Storage Procedures for Atomic Weapons and Components (U).

3. Army Regulations

AR 55-162 Permits for Oversize, Overweight, or Other Special Military Movements on Public Highways.
AR 55-355 Military Traffic Management Regulation.
AR 58-1 Joint Procedure for Management of Administrative Use Motor Vehicles.
AR 320-5 Dictionary of United States Army Terms.
AR 320-50 Authorized Abbreviations and Brevity Codes.
AR 345-210 Records Management; Files Systems and Standards.
AR 380-5 Safeguarding Defense Information.
AR 385-40 Accident Reporting and Records.
AR 385-55 Prevention of Army Motor Vehicle Accidents.
AR 600-55 Motor Vehicle Driver—Selection, Testing, and Licensing.
AR 700-10 Registration of Motor Vehicles.
AR 700-2300-1 Motor Vehicles.
AR 746-2300-1 Color and Marking of Vehicles and Equipment.
AR 750-1 Concept of Maintenance.

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USACGSC (50)
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 MFSS (20)
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NG: State AG (3); units—same as active Army except allowance is one copy to each unit.

USAR: Same as active Army except allowance is one copy to each unit. For explanation of abbreviations used, see AR 320-50.

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